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RADIO NEWS

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1922

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Edited by H. GERNSBACK

"THE 100% WIRELESS MAGAZINE"

CIRCULATION LARGER THAN ALL OTHER RADIO MAGAZINES COMBINED

"Amplifies as it detects"

Cunningham Tubes

For Home Receiving Sets

Cunningham
C-300
Gas Content
Detector

$5.00

THE many Radio Telephone Concerts and market reports and other news interest broadcasted daily has created a new and very exacting use for Detector Tubes.

Cunningham Type C-300 Gas Content Detector Tube is nationally recognized as the one tube which gives the most satisfactory results for any type Receiving Set applicable to wave lengths between 100 and 3000 meters for both spark and C.W., Telegraph and Telephone. In addition to its wonderful detector properties, low B. battery quietness in operation, it is a free and persistent oscillator for regenerative amplification and C. W. reception and functions without distortion of the received signals.

The pleasure and satisfaction from operating this tube in connection with home receiving sets has resulted in our having received many letters from enthusiastic users.

For further particulars see or write your nearest dealer or write us direct.

Dealers should take advantage of the enlivened interest taken by the fathers and mothers of the amateurs throughout the country who today look upon radio concerts, etc., as a very interesting and highly instructive form of entertainment. Dealers will make no mistake in stocking Cunningham Tubes and Remler Apparatus.

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CUNNINGHAM TUBES MEET EVERY AMATEUR REQUIREMENT

The trade mark GE is the guarantee of these quality tubes. Each tube is built to most rigid specifications.

Announcing the New All-Rubber Radio Battery

The Willard All-Rubber Radio Battery is made the right size for radio work, thereby reducing cost. Expensive and unnecessarily heavy connectors have been replaced by lighter ones, still further lowering the price at which you can get a genuine Willard Battery for your radio work.

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Any of the 3000 Willard Battery Stations can give you full information about this new battery, or we will gladly furnish it direct.

WILLARD STORAGE BATTERY CO.
Cleveland, Ohio

Willard Storage Battery Company of Canada, Limited,
Toronto, Ontario

Willard THREADED RUBBER BATTERY

RADIO NEWS

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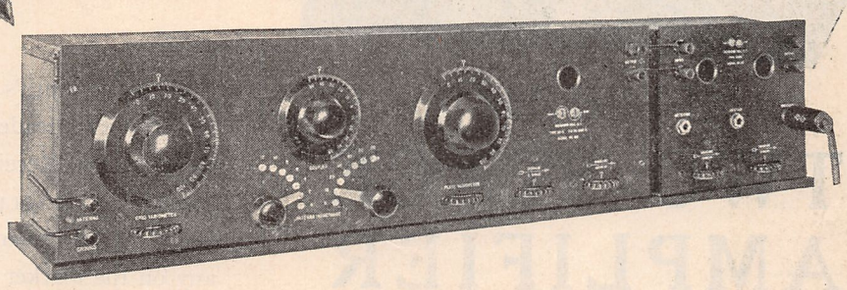
A man without thought for the future — must soon have present sorrow-
Think of the coming clear cold nights and buy that **Grebe Receiver** Now!

Doctor Thy



Licensed under Armstrong U. S. Patent No. 1,113,149

DEALERS who realize the value of highly satisfied customers recommend and sell Grebe Radio Apparatus. These dealers know good apparatus. They know also that the Grebe slogan:—"Each instrument manufactured by us must give satisfactory service"—means exactly what it says.

If your dealer cannot show you the Grebe line send us a postcard, mentioning his name.

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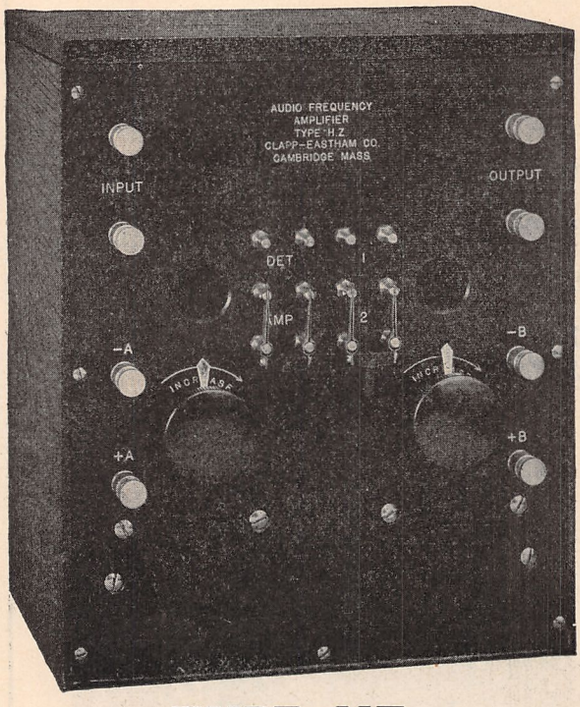
CLAPP-EASTHAM QUALITY



TYPE HZ TWO-STAGE AMPLIFIER

Here is the very latest thing in Amplifiers

—A companion piece to our HR Receiving Set advertised in RADIO NEWS last month

In last month's issue of this magazine we introduced to RADIO NEWS readers the new CLAPP-EASTHAM Type HR Regenerative Receiving Set—licensed under Armstrong U. S. Patent No. 1113149. We sell this set complete for only $35, yet absolutely guarantee it to give results equal or superior to any on the market regardless of price.

We promised you that this set would surprise you and your friends by its easy control and the wonderful distances at which it picks up signals, voices, music—and the great clearness and loudness with which these signals come in.

Now we want to tell you about the companion piece to this remarkable receiver—the new CLAPP-EASTHAM *Type* HZ TWO-STAGE AMPLIFIER equipped with our new "Maximus" Amplifying Transformers. Amplifies weak signals hundreds of times—sounds almost inaudible are made to ring throughout a large room. Convenient switching arrangement permits use of Detector only, one stage of amplification, or two stages. This Amplifier exactly matches our HR set in size, finish and arrangement of binding posts, yet is equally effective with receiving sets of other types and makes.

Price complete, $35. Write us for full details and name of nearest dealer.

Any of the radio Dealers advertising on the following four pages of this magazine will sell you a type HR Regenerative Receiving Set, or Type HZ Two-Stage Amplifier—$35 each. Buy from the dealer nearest your city.

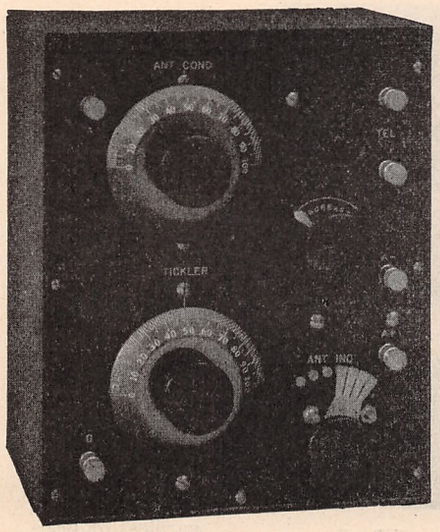
CLAPP-EASTHAM COMPANY

RADIO ENGINEERS AND MANUFACTURERS

120 Main Street : : : : CAMBRIDGE, MASS.

California Representative: **LEO J. MEYBERG CO., San Francisco and Los Angeles**

CLAPP-EASTHAM SERVICE



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters. Licensed under Armstrong U. S. Patent 1113149.

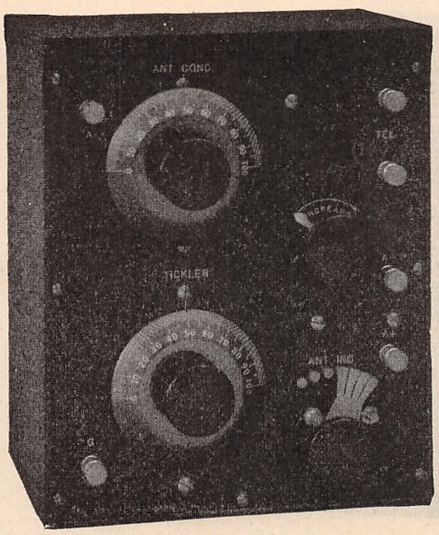
No Better Set at any price

This $35 set is guaranteed by the makers to give results equal or superior to any on the market, *regardless of price.*

See this Set in BOSTON

At our stores in Boston, Mass,, and Providence, R I; or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

F. D. PITTS COMPANY
12 Park Square **BOSTON, MASS.**



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

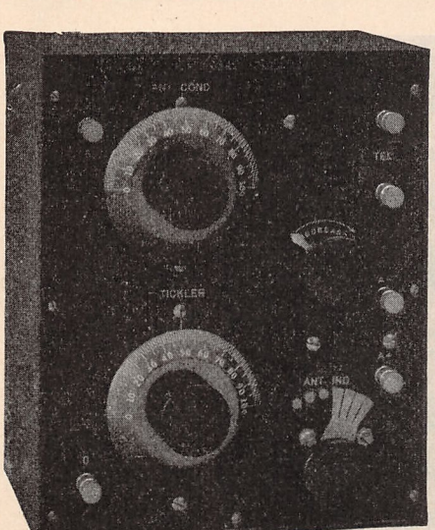
$35 Buys this set

Includes tube socket and rheostat. Wired ready for use. A set you will be proud of.

See this Set in CHICAGO

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

RAY-DI-CO ORGANIZATION
1547 N. Wells Street **CHICAGO, ILL.**



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

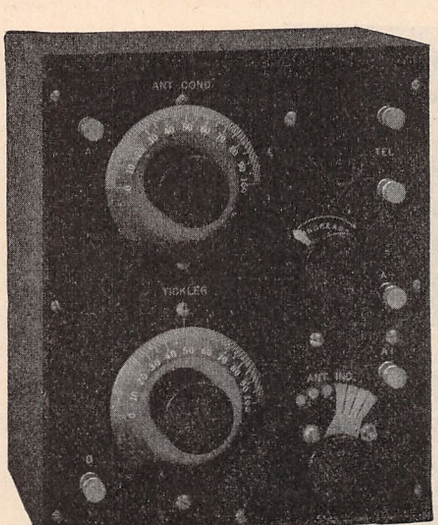
The Set with the Easy Control

It's a set that is not only wonderfully efficient, but has the best control you ever used. And costs only $35.

See this Set in NEW YORK

At our stores in New York, Philadelphia, Baltimore, Norfolk, Savannah, New Orleans, Portland, Ore., and London. Or write for details and catalog.

SHIP OWNERS RADIO SERVICE
80 Washington Street **NEW YORK, N. Y.**



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

Get Distant Music Voices, Signals, Loud and Clear

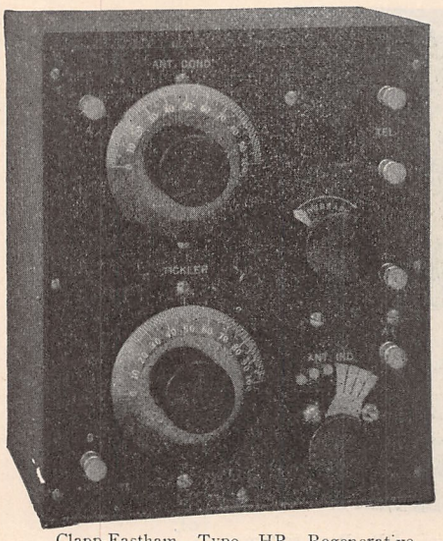
You can do it with this $35 set. Best results guaranteed by makers.

See this Set in PITTSBURGH

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

LUDWIG, HOMMELL & COMPANY
530 Fernando Street **PITTSBURGH, PA.**

CLAPP-EASTHAM QUALITY



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

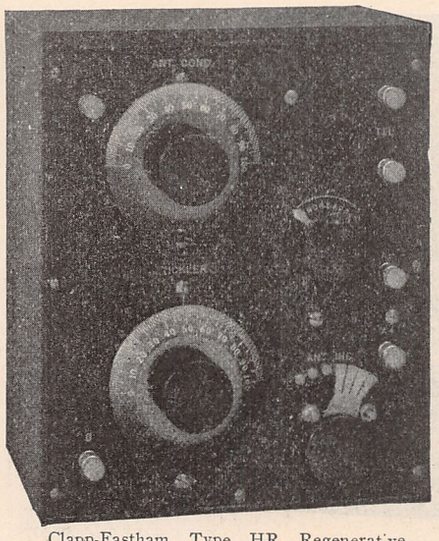
$35 Buys this Set

Perfect Regeneration at all wave-lengths. Wonderfully simple control.

See this Set in CLEARWATER, FLA.

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

SOUTHERN RADIO SUPPLY COMPANY
CLEARWATER, FLORIDA



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

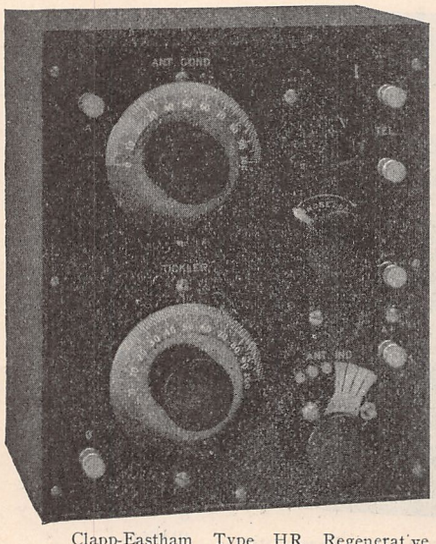
Low Cost But Big Results

Only $35, but absolutely guaranteed to give results equal or superior to any on the market regardless of price.

See this Set in NEW KENSINGTON, PA.

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

VALLEY ELECTRIC COMPANY
Copeland Building NEW KENSINGTON, PA.



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

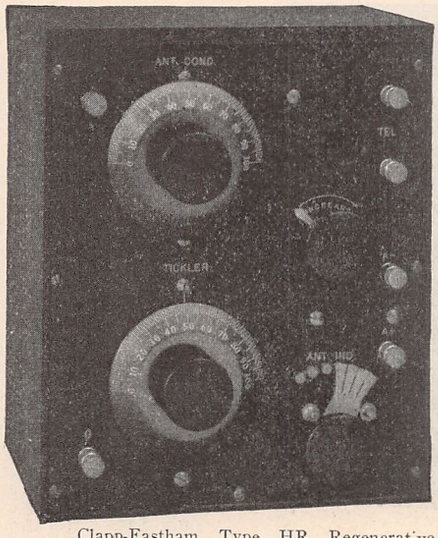
A Set You Will be Proud of

Costs only $35, but will give results that will astonish your friends who own more expensive sets.

See this Set in DAYTON, OHIO

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

WILLIAM HALL ELECTRIC COMPANY
DAYTON, OHIO



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

The Latest Thing in Receiving Sets

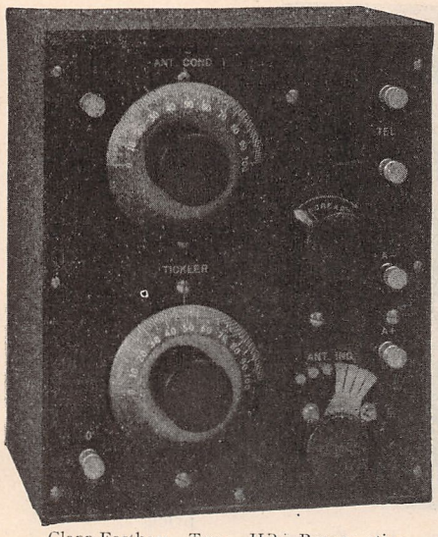
You will be delighted at the distance, clearness and loudness of music, voices and signals received. Only $35.

See this Set in WESTERLY, R. I.

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

WHITALL ELECTRIC COMPANY
WESTERLY, R. I.

CLAPP-EASTHAM SERVICE



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

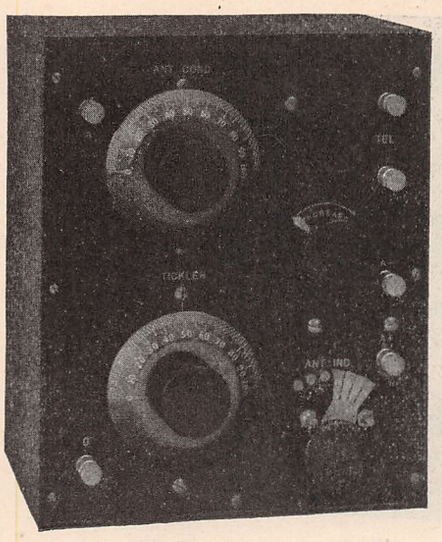
The Set with the Easy Control

This $35 set is guaranteed by the makers to give results equal or superior to any on the market, *regardless of price.*

See this Set in KANSAS CITY, MO.

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

CENTRAL RADIO COMPANY
575 Grand Avenue KANSAS CITY, MO.



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

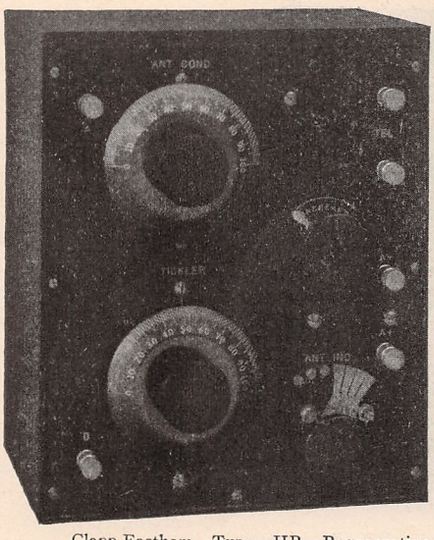
Wired Ready for Use

This set is complete when you get it. Includes tube socket and rheostat. Wired ready for use.

See this Set in NEW YORK

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

DREYFUS SALES CORPORATION
179 Greenwich Street NEW YORK CITY



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

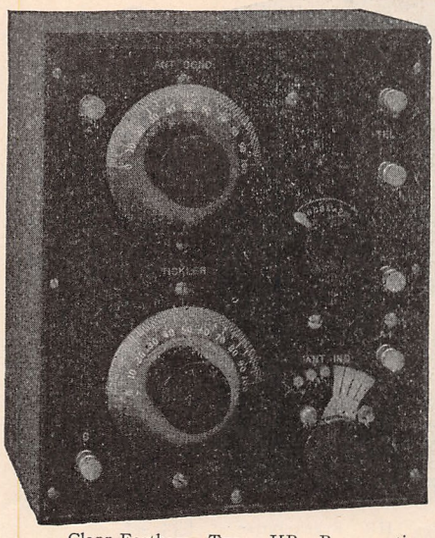
For Distance Clearness Loudness

This $35 set will surprise your friends who own more expensive equipment. Remember that this set is fully guaranteed by the maker.

See this Set in DETROIT

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

DETROIT ELECTRIC COMPANY
434 Shelby Street DETROIT, MICH.



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

$35 Buys this Set

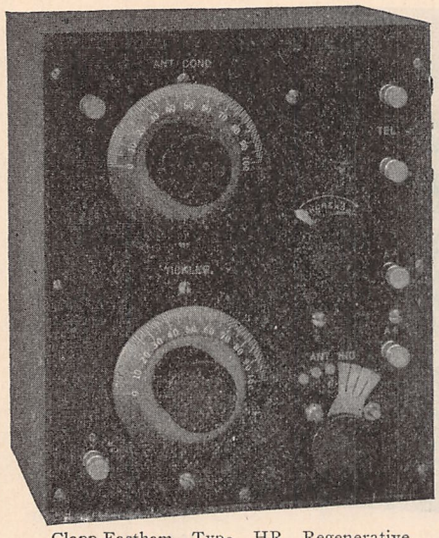
Perfect Regeneration at all wave-lengths. No capacity effect from hand or body.

See this Set in UNIONTOWN, PA.

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

REED AUTOMOTIVE SERVICE
97 West Main Street UNIONTOWN, PA.

CLAPP-EASTHAM QUALITY



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

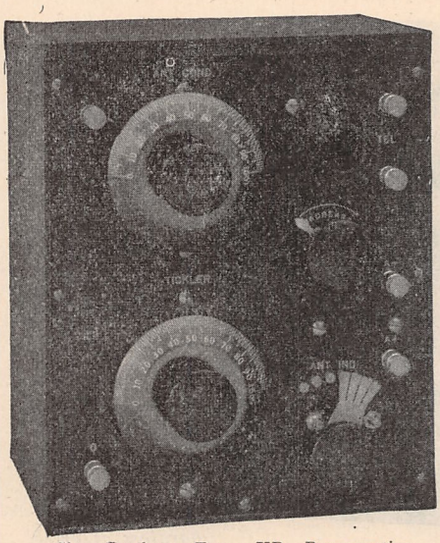
Best Control You Ever Used

You will like the ideally simple control of this wonderful $35 Regenerative Receiving Set. Perfect Regeneration at all wavelengths.

See this Set in COLORADO SPRINGS

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

REYNOLDS RADIO COMPANY
729 South Prospect St., COLORADO SPRINGS, COL.



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

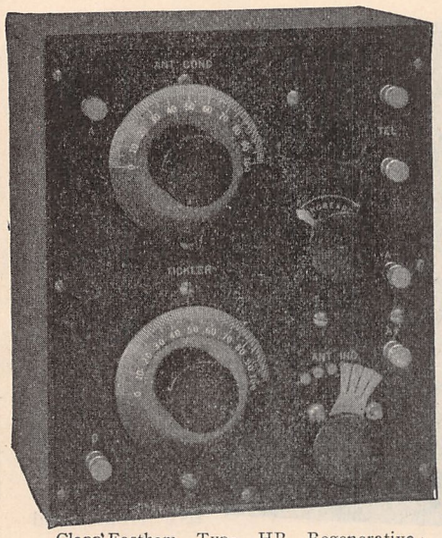
No Better Results at any Price

This set is guaranteed to give results equal or superior to any on the market regardless of price.

See this Set in PITTSBURGH

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

ALLIED ELECTRIC COMPANY
715 Liberty Avenue PITTSBURGH, PA.



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

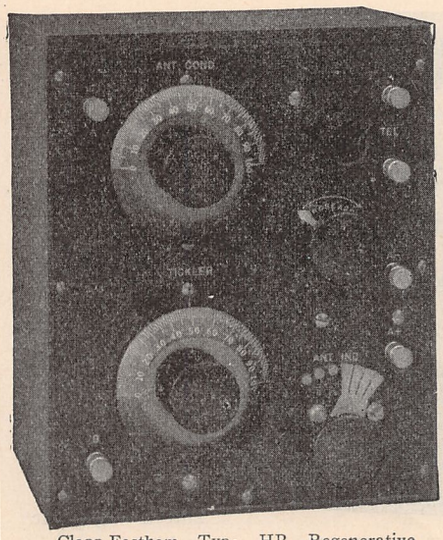
Get Distant Music, Voices, Signals, Loud and Clear

You will be proud and delighted with the wonderful appearance and performance of this $35 set.

See this Set in CHICAGO

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

TELEPHONE MAINTENANCE CO.
17 N. La Salle Street CHICAGO, ILL.



Clapp-Eastham Type HR Regenerative Receiver. Wave length 180 to 825 meters.

$35 Buys this Set

The very latest and most up-to-date development in high efficiency regenerative receiving sets.

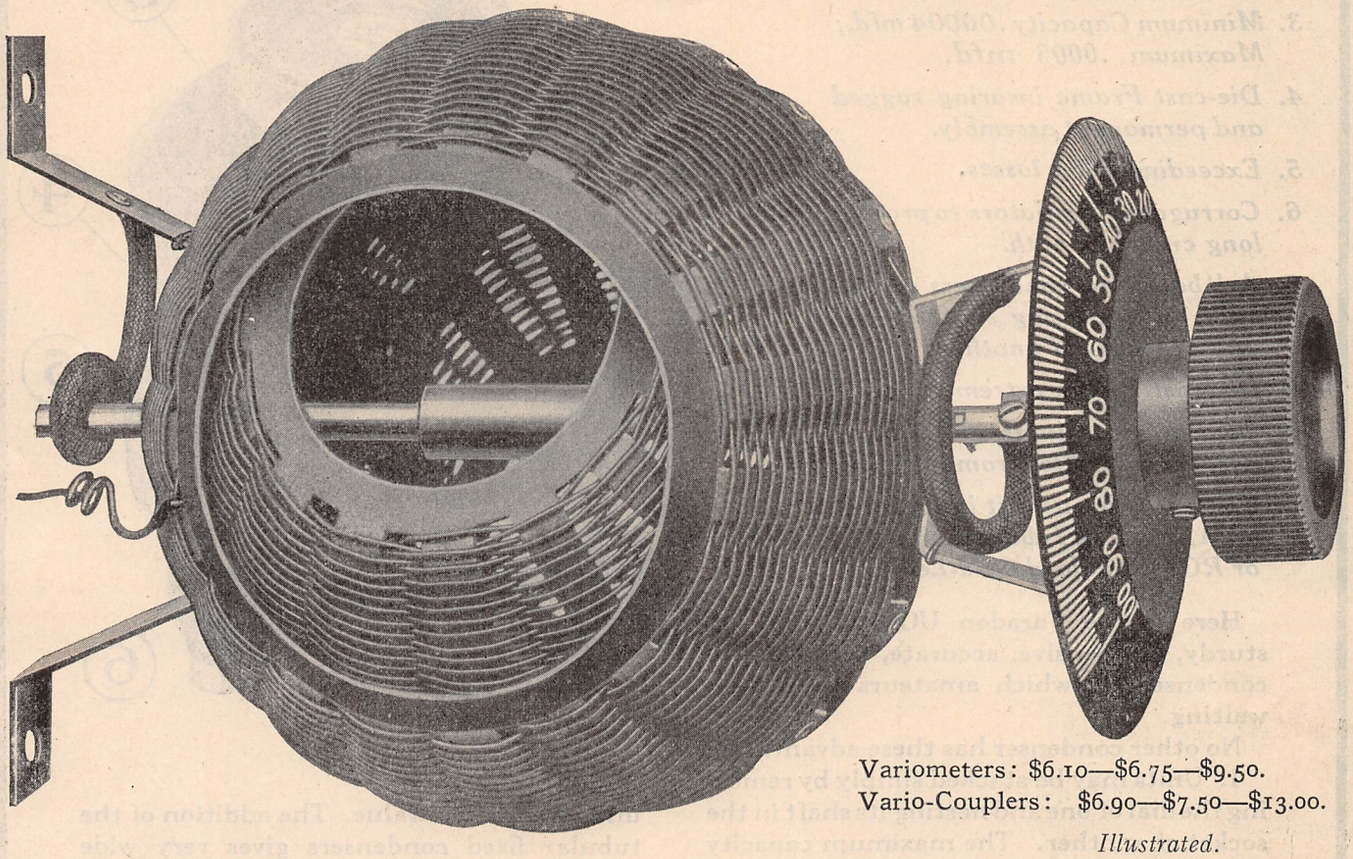
See this Set in WORCESTER, MASS.

at our headquarters or order direct by mail. Full details of this set and complete line of other radio equipment free on request.

DELTA ELECTRIC COMPANY
658 Main Street WORCESTER, MASS.

AMRAD

The Recognized Symbol of Superior Performance



Variometers: $6.10—$6.75—$9.50.
Vario-Couplers: $6.90—$7.50—$13.00.

Illustrated.

Amrad BASKETBALL* Variometer

There are SIX styles of Amrad Variometers and Vario-Couplers — each a BASKETBALL. The unique method of winding, the high electrical efficiency, the trim appearance, lightness and rigidity have won for BASKETBALLS an enviable reputation.

BASKETBALLS are used exclusively in Amrad Short Wave Tuner 2596—one of the reasons for the large sale of this instrument. Quite naturally, too, the BASKETBALL is now the vital element around which is built the new Amrad Crystal Receiver No. 2575—the beginner's Receiving Set de Luxe.

Ask your dealer to show you BASKETBALLS and INSIST on this exclusive basket-weave. If your dealer doesn't stock, place your order with him and he will fill it quickly. Look for the green and yellow Amrad labels in the better stores.

Descriptive Bulletin O free on request
Complete Catalog 10 cents in stamps

**Name submitted by Monroe Cox, of Swampscott, Mass., winner of First Award in Amrad Double Prize Contest.*

AMERICAN RADIO AND RESEARCH CORPORATION

General Office, Factory and Laboratory

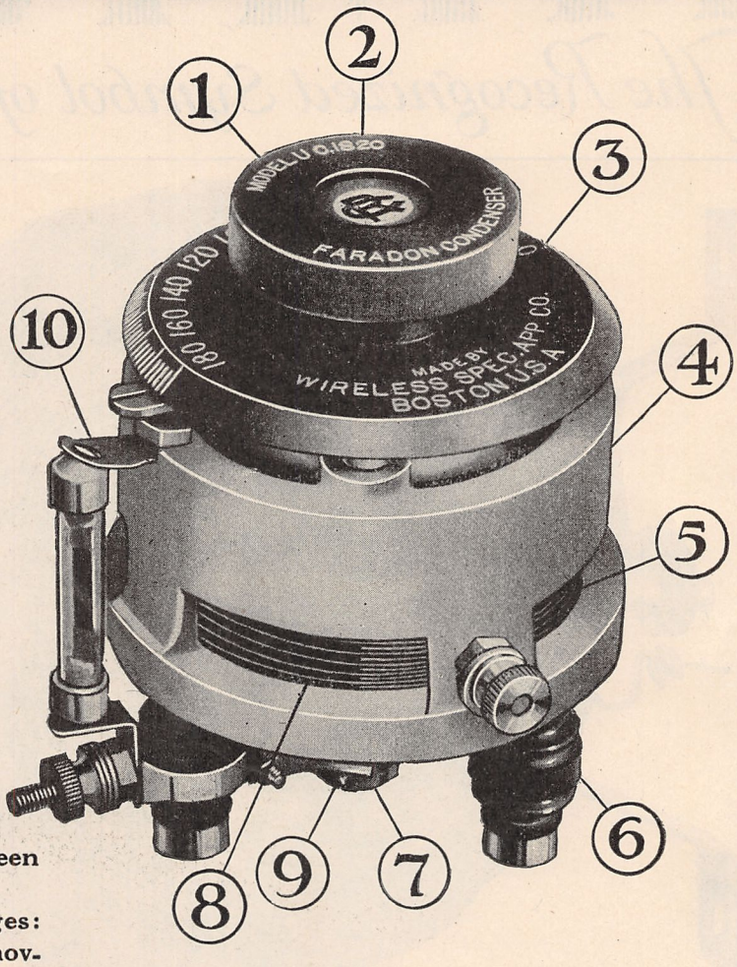
New York District Office
21 Park Row

203 College Avenue, Medford Hillside, Mass.
(SUBURB OF BOSTON)

Chicago District Office
600 So. Dearborn St.

Lowest-Priced of Precision Condensers
FARADON UC-1820

1. *Molded Bakelite Dial and Knob by which one or a "bank" of condensers may be operated.*
2. *Panel or Bench Mounting.*
3. *Minimum Capacity .00004 mfd.; Maximum .0006 mfd.*
4. *Die-cast Frame insuring rugged and permanent assembly.*
5. *Exceedingly low losses.*
6. *Corrugated Insulators to provide long creepage path.*
7. *A "bank" of condensers can be built up by nesting shaft of one unit in socket of another.*
8. *Die-cast Plates extremely rigid.*
9. *Two or more units in series or parallel controlled from one knob.*
10. *Contact Clips permit insertion of RCA Standard Tubular Condenser or RCA Standard Grid-Leak.*



Here is the Faradon UC-1820, the sturdy, inexpensive, accurate, variable condenser for which amateurs have been waiting.

No other condenser has these advantages:

1. Units may be stacked simply by removing the dial of one and nesting its shaft in the socket of another. The maximum capacity of a single unit is .0006 mfd. Two units in parallel have a combined capacity of .0012 mfd. Connected in series the two have a maximum capacity of .0003 mfd. and will withstand double the voltage of a single unit.

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Radio Corporation of America

WORLD WIDE WIRELESS

233 BROADWAY—NEW YORK CITY

RADIO NEWS

H. GERNSBACK—Editor
ROBERT E. LACAULT—Associate Editor

Vol. 3 FEBRUARY, 1922 No. 8

Announcement

THE publishers beg to announce that beginning with the March issue the price of this publication will be increased to 25c. per copy, by subscription $2.50 per year in United States, and $2.75 a year in Canada and foreign countries.

We have long hesitated to make this important change, but we plan, not only to keep up the high standard of the publication, but to keep adding to the exclusive features of RADIO NEWS during the next year, and we promise you a radio magazine such as you have never before dreamed possible.

The price of RADIO NEWS since the February, 1920, issue has been 20c. At that time the publication had but 64 pages. Since then, we have increased the page numbers to 104, and beginning with this issue, the number of pages will be 112.

In January of this year we added a Rotogravure section, which has greatly improved the appearance of the magazine, and this change, of course, is costly. In this issue you will notice the Rotogravure section has been increased to twice the size of the January Roto. It is true that we are buying our paper cheaper to-day than we did formerly, but our printing costs, our art work, our engraving, our administration expenses, have not decreased. Rather they have increased in many instances.

The price of the publication should have been increased to 25c. early in 1921, but it was decided at that time to let the advertiser absorb most of our burden. This the advertiser did very reluctantly, and in fairness to him, we cannot tax him any further.

We have made this publication the best in the world to-day, a magazine such as the Radio Fraternity never hoped to own. In point of advertising, according to the statistical figures compiled by *Printers' Ink*, reproduced herewith, RADIO NEWS to-day stands in the eighth place with all the monthly magazines in the United States, eclipsing such important publications as *Good Housekeeping, Woman's Home Companion, Popular Science*, etc., etc.

Now that the radio art has been lifted out of the "bug" class, and now that the public is becoming interested in it, it has become necessary for the publishers of this magazine to keep up with all of the latest developments; there was only one way to accomplish this and that was to increase the number of pages, which we have done time and again. We are now giving exactly 75 per cent. more reading matter than we gave two years ago, when the price of the publication was 20c., and we believe that we are not taking an unfair advantage of the reader when we ask him to pay 25 per cent. more for this service.

We have always pursued the policy of giving more for your money than you expected, and we will continue to do so in the future. If it is found necessary to still further increase the number of pages of the magazine, the publishers will do so cheerfully, if it helps the good cause along.

RADIO NEWS is paying the highest prices for all contributions, and it is well known that we have always been liberal with illustrations and expensive engravings in order to bring out a difficult point or to make an important article more readable. That policy has made RADIO NEWS the great publication it is today, and we will of course continue this policy now that we will be enabled to expend still more money upon our work.

With the March issue, the cover of the magazine will also be varnished, greatly enhancing the beauty of the magazine, and that and subsequent issues will be bound with the square back, instead of being saddle-stitched as the magazine is now.

The circulation of RADIO NEWS has increased tremendously, our press run of this issue being 75,000 copies—a circulation unprecedented for a radio magazine, and undreamed of even by the publishers, when the magazine was founded. The increase in circulation will make it possible to supply copies to many readers who have been disappointed in the past.

The publishers desire to express their thanks to the readers for their coöperation, and assure them that they will not be disappointed in the future. RADIO NEWS is the first publication in its class, and will always remain so, if it depends upon the publishers. THE PUBLISHERS.

PRINTERS' INK Jan. 12, 1922

RECAPITULATION OF ADVERTISING IN MONTHLY CLASSIFICATIONS

	Columns	Lines
1. Motor	969	162,792
2. Ladies' Home Journal	289	49,185
3. Vogue (2 issues)	248	39,338
4. MacLean's (2 Dec. issues)	211	37,017
5. Popular Mechanics (pg.)	159	35,700
6. Motor Life	173	27,334
7. Physical Culture	184	26,355
8. Radio News	173	25,546
9. Arts & Decoration	112	25,144
10. Country Life	148	24,903
11. System	171	24,554
12. Vanity Fair	153	24,224
13. House & Garden	152	24,139
14. Harper's Bazar	138	23,257
15. Good Housekeeping	162	23,241
16. Review of Reviews (pg.)	98	22,008
17. West'n H'me Mo. (Dec.)	118	21,406
18. Woman's Home Comp.	120	20,400
19. Pictorial Review	101	20,302
20. Normal Instructor	110	18,806
21. Red Book	130	18,673
22. American	128	18,304
23. World's Work (pg.)	79	17,716
24. Science & Invention	118	17,361
25. Popular Science Mo.	111	16,930

NEW $350 PRIZE CONTEST

If radio is to be the great thing we all expect it to be some day, it will be necessary for the public to become more and more interested in its wonders. Not everyone can afford a vacuum tube set that brings in the music loudly and audibly to an audience. Such a set costs anywhere from fifty to seventy-five dollars at this time, and the disappointment of many people when they find out what such a set will cost them is keen.

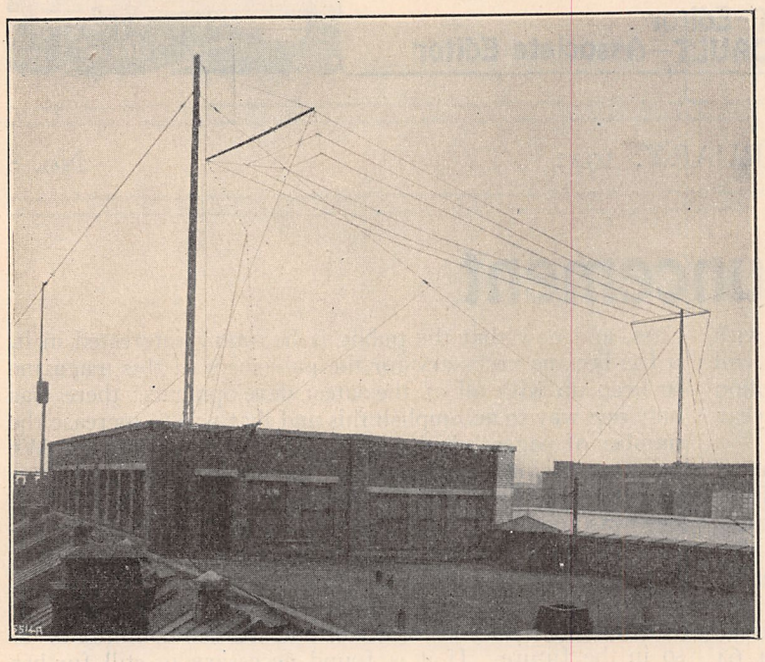
With a view to satisfying such a demand, and in order to do something really big for the radio art, a popular-priced crystal set that will amplify the voice and music is badly needed.

We are sure that the readers of RADIO NEWS can develop something worth while along this line, if they put their minds to it. Is it possible to make an amplifier that works satisfactorily from a crystal set?

For full particulars of this contest, which will be quite out of the ordinary, be sure to see the March issue. $350.00 in prizes will be awarded.

Grand Opera Broadcasting

By ROSCOE I. SMITH



General view of the aerial and counterpoise installed on the roof of the Chicago Grand Opera for the broadcasting of the performances by radiophone

LIKE a sunburst after a long and dark night, wireless telephony has been assured a new and practical usage in the everyday social lives of the people of the Middle West. Radio telephony now has made possible the transmission of Grand Opera over an area roughly estimated at 750,000 square miles, stretching over a great circle with Chicago as the pivotal or central point of distribution.

More than 50,000 persons, scattered from New York to Kansas and from Southern Kentucky to Northern Minnesota, heard the first test of opera broadcasted to all points of the compass.

Proof that the test signals were "QSA" (clear and loud) soon poured in from every direction after the demonstration was completed. The original tests were made with a view of inaugurating a season of Grand Opera by wireless starting with the opening of the Chicago Grand Opera season. The aerial consisting of four wires, equally spaced on a 20' spreader, was temporary and not the length it is designed to be ultimately.

The test was made under actual operatic conditions, opening with an address by Director Mary Garden, an orchestra selection led by Giorgio Polacco and Miss Edith Mason's aria from "Madame Butterfly."

The transmission of Grand Opera over such a wide area by radio telephony was initiated by the Westinghouse Electric Company when the company established its fourth radio broadcasting station on the roof of the Commonwealth Edison Building at Chicago, the installation being supervised by George Foster of the latter company, with the co-operation of G. H. Jaspert, publicity director of radio for the Westinghouse firm.

Small transmitters placed high up in the wings above the Auditorium stage catch the music and carry the tones to the Westinghouse station, "KYW," from whence the waves are sent broadcast on a 360 meter wave-length, without further relay.

For some days notices had been sent by wireless to middle western stations of the preparations afoot for the test. Amateurs and professionals alike were made familiar with the details being worked out at "KYW," and needless to say everybody "listened in," and soon great batches of letters began coming in from Texas, North Carolina, Vermont, Minnesota, Canada and many other places reporting that they heard the preliminary tests perfectly and seeking further information of the new application of the science of broadcasting the world's best music.

After the first concert test was completed and its success assured the first regular opera carried to the ears of the widely scattered auditors was "Samson and Delilah" the wonderful solos and striking storm effects being reproduced perfectly. Since this performance, the golden strains have been going out nightly to select audiences at such widely scattered points as Watertown, N. Y., Kansas City, Mo., Minneapolis, Minn., Covington, Ky., and many other points. Radio telephony did the trick. The operators in charge of the station several times have had their hands full in assuring perfect continuity. At first the microphones have at times "gone dead," but the ingenious arrangement for picking up the music has always made it possible to broadcast the complete opera without a break and those listening over the wide area did not know that troubles had been met and overcome.

Locally, many stations were turned in to hear the first opera. The Chicago *Tribune* plant served the editorial force with the music with equal facility for stations a thousand miles distant. At many stations in the city, family groups gathered around the radio receiver while the genius of the amateur was now made really manifest in a practical way never before demonstrated to the layman parent. "Stay at home" opera lovers began to realize the dawn of a new era for the satisfying of their artistic desires, and wireless took on a more practical shape than when Jack, or John, or Charlie had bored them with mysterious apparatus and problems of location for antennae.

Now that the high cost of opera is smashed, and wireless has become as practical as the telephone and the elevator, science has abridged another epoch and humanity is the richer. Edward Bellamy's dream, made known in his memorable "Looking Backward," published in 1888, where in the great co-operative commonwealth of the twenty-first century nobody need leave their homes to hear the great musical concerts, seemed to have been strangly fulfilled in the achievement at Chicago, much sooner in the world's progressive sweep onward than prophesied by the Boston economist. In that tale, householders gathered in ther "musc rooms," touched a button and the concert commenced, lasting for certan lengths of time each afternoon and evening. Hidden amplifiers gave one the impression the music was in the next room.

Uptown on the North Shore, Jack Callanan (9AOY), the Lane High School wireless expert, was "all set" with his splendid equipment while the Callanan family no doubt realized the wonderful results of time well spent in study and mechanical preparations, traits that Jack is noted for. Jack also had a hand in managing the Marshall Field store broadcasting apparatus installed for the holidays.

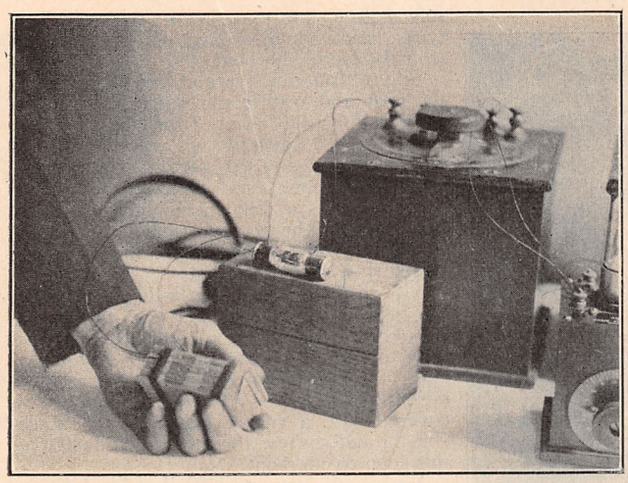
And so the story runs—many evidences

(Continued on page 728)

Inside view of the radiophone station of the Chicago Opera House. The voice and music are picked up on the stage by several microphones connected to this set and radiated over a large area, enabling anyone with a receiving set to hear the whole performance.

Do Insects "Talk" by Wireless?

By RAYMOND F. YATES



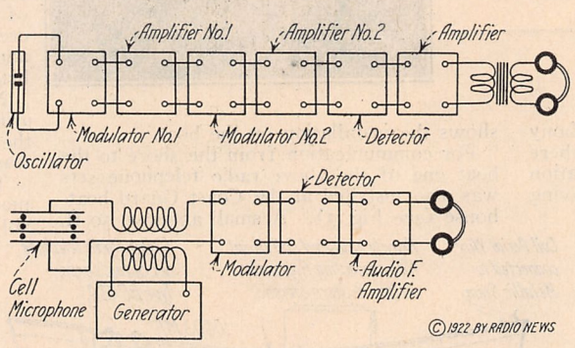
The photograph on the right is of Mr. Horle, who is experimenting to find out if insects communicate by radio. On the left is a detailed view of the small oscillator and cell microphone used by Mr. Horle in his experiments.

WAS Marconi the first to apply ether waves to a practical use or did Mother Nature beat him to it? That is a question that entomologists are now interested in. Do bugs talk to each other by radio? Preposterous you say? Not necessarily so. In the firefly we have a creature that is able to produce within its own body visible radiations. We now know that the difference between visible and invisible radiations is simply a matter of wave-length. Wireless waves take their place at one end of the spectrum.

If a creature like the firefly can set up visible radiations, why cannot other creatures set up invisible radiations? This hypothesis is not as speculative as it would appear at first thought. In fact, it is quite reasonable.

There are certain water creatures that are able to generate within their own bodies electrical currents of no mean potential. The Gymnotus and the Torpedo can give a shock that will make even a strong man develop considerable respect for them, once he has had the misfortune of coming in contact with them. The Torpedo has arranged within its body a series of electric cells which generate a very high potential. Here is another instance where Nature shows us that she can make a veritable power house of a living thing. Now, if a creature has within its body a generating plant, is it possible that this source of energy could be propagated as ether waves? That is at least a logical line of thought. The human heart produces weak galvanic currents. We know then that a living organ can be the seat of a potential difference.

Entomologists have long since known that moths and certain other insects can call each other over considerable distances. First it was suggested that sound was used, but investigation tends to prove that this is not so. Then scent was suggested, but this theory was battered down as impossible. For instance, the male can fly to the female down the breeze as well as up the breeze. Moths have been placed in scent- and sound-proof boxes and yet they were able to summon the males without failure.



In His Experiments Mr. Horle Uses Either a Super-sensitive Microphone or a Special Oscillator Designed by Him and Connected in the Circuits Shown Above.

Mr. Lawrence Horle, a well-known radio engineer and former Bureau of Standards expert, has conducted some extremely interesting experiments along this line. He, of course, assumed that in case the moths did send forth electromagnetic waves, they were of very short wave-length since the oscillator would be of diminutive size. Mr. Horle's problem was that of producing a radio receiving equipment that would be sensitive to the shorter wave-lengths. Although waves have been produced with lengths as short as a sixth of an inch, no receiver had been developed previous to Mr. Horle's work that would respond to such small radiations.

Before going into the radio side of this story, it is interesting to know of the ingenious method of sound detection that was employed by Mr. Horle to disprove the theory that the insects communicated with one another by sound impulses. This problem brought into being the necessity of designing a detector that would respond to frequencies which fall within the supersonic range. The detector used was really a condenser the capacity of which was changed with the passage of sound waves through it. Because of the extremely high sound frequencies to be expected, such a change of capacity could not be expected from the motion of metal masses. It is known that sound waves consist of air pressure variations. If sound waves are allowed to pass through a condenser with properly spaced plates, the capacity of the condenser will be changed since the dielectric strength of the air depends upon its pressure among other things. Because of the extremely low inertia of the molecular structure of air, the method outlined above is ideal in the detection of sounds of a supersonic nature. The changes in capacity produced by the passage of the sound waves can readily be converted into current changes and, by the use of suitable audion amplifiers, made audible or visible.

Although much experimentation was carried on with the apparatus mentioned above, no unusual sounds of a supersonic range were detected in the presence of a male and female moth. The experiment of placing the female moth in a sound-proof container was also tried, but the male always responded to the calls of the female and often walked or flew about the container in an effort to reach the troubled partner. These experiments were abandoned for radio.

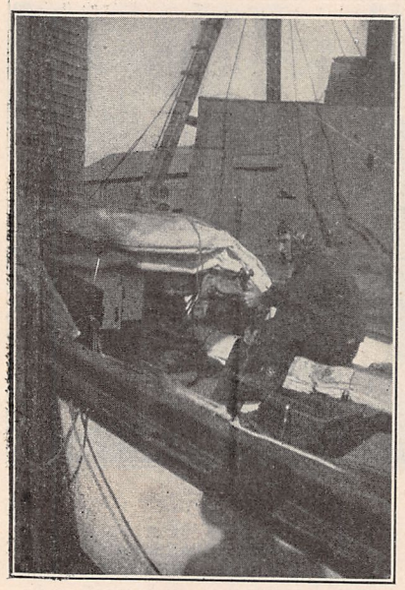
The detection of radio waves of extremely high frequency is a matter of great difficulty. If moths

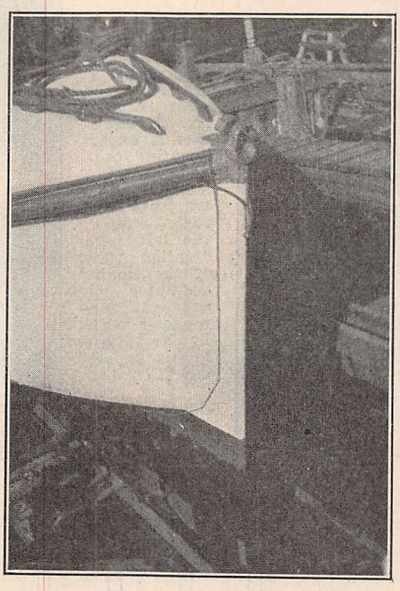
(*Continued on page 752*)

The Moth in the Jar is Calling its Mate. Mr. Horle is "Listening in" With His Super-sensitive Receiver, Which Was Designed to Respond to Extremely Short Wave-lengths

The Development of Radio Telephone Communications Between Lifeboats and Shore Stations

By F. W. DUNMORE*

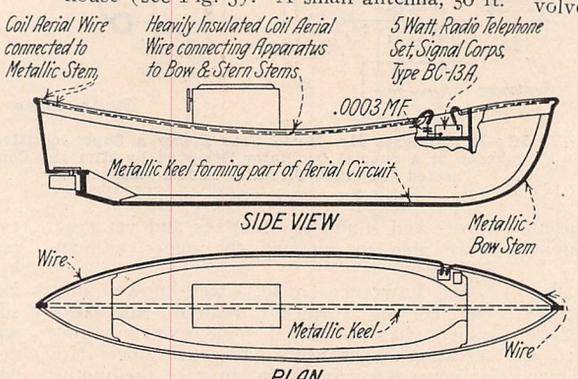




On the left may be seen the operator aboard the lifeboat wearing the special helmet in which are mounted the receivers. This helmet is similar to those used by operators aboard airplanes. On the right is a detailed view of the loop aerial showing how it is fixed on the hull of the boat.

AN important field for radio telephony is its use on Coast Guard boats where the maintenance of communication with shore may result in the saving of many lives.

This report describes the development of such a means of communication, which was recently undertaken by the Bureau of Standards in co-operation with the U. S. Coast Guard. The final tests were conducted under actual working conditions on a 36-ft. non-sinkable self-righting motor lifeboat at Atlantic City, N. J. The results of preliminary experiments conducted at the Bureau of Standards are outlined in Bureau of Standards radio laboratory report CR412f by M. S. Strock. These experiments, while presenting but few of the problems to be met with under working conditions, were sufficiently satisfactory to warrant further tests with the installation on the boat which were conducted at Atlantic City, N. J., November 7-16, 1921.



The Loop Aerial Used Aboard the Lifeboat is of Unusual Design. The Keel Forms Part of the Circuit as Shown in This Drawing.

REQUIREMENTS

The problem involved in the development of a means of radio telephone communication from a Coast Guard lifeboat to the shore, is that of finding a suitable transmitting antenna for the lifeboat, the conditions being that no loose wires could be strung over, under, or in the boat. These rather rigid requirements are made necessary by the fact that a lifeboat is subject to the most severe conditions, even to the extent of being capsized. Furthermore, loose antenna wires strung over the boat, or trailing wires under the boat, would materially hinder the quick and efficient manoeuvering of the boat, the throwing of lines, etc.

EQUIPMENT USED

The lifeboat upon which these tests were conducted was the one used at the Coast Guard Station No. 123, Atlantic City, N. J. Fig. 1 illustrates this type of boat. It is a wooden boat, 36 ft. long, with metal keel. It is motor driven, self righting and self bailing.

The type of radiophone used for the tests was the Signal Corps type BC-13-A. The tubes used in this set are the Western Electric Co. type VT-2. These tubes are rated as 5-watt tubes. One is used as the power tube and the other as the modulator. Fig. 2 shows the installation on the boat.

For communication from the shore to the boat one of the above radio telephone sets was also installed at the Coast Guard boathouse (see Fig. 3). A small antenna, 50 ft. high and 60 ft. long, was erected and a few wires put in the water to secure a ground connection.

The receiving set, also shown in Fig. 3, which was used at the land station consisted of type B medium wave receiver, which is manufactured by a well-known Corporation, used with an amplifier consisting of three stages of radio frequency amplification, a detector, and two stages of audio frequency amplification, especially designed for maximum sensitivity between 1,000 and 750 kilocycles (300 and 400 meters).

The receiving set used on the boat was a 1605-B, 500-130 kilocycles (600-2,300 meters) 6-tube radio-audio amplifier, directly connected to the terminals of a 0.003 microfarad variable condenser, connected across the terminals of the transmitting coil aerial described below.

ANTENNA ON BOAT

As stated above, the use of the ordinary type of antenna for a Coast Guard boat was out of the question. The coil aerial seemed to offer the next best possibilities and so the work of finding a suitable antenna resolved itself into experiments with different types and combinations of coil aerials wound around the boat.

Several different types of coil were put on the boat and tests made with the boat anchored 1½ miles away from the receiving station. A transmitting wave-length of 789.5 kilocycles (380 meters) was used. The radiophone set was connected to the coil aerial as shown in blueprint Radio No. 788. Of the several combinations tried, the three which proved to be the most satisfactory will be described.

No. 1 coil was as shown in blueprint radio No. 788, except for the fact that the single-turn coil, or loop, was a complete circuit of wire, the keel not forming part of the circuit. It consisted of one turn of wire composed of 36 strands of No. 28 copper wire covered with a rubber insulation ⅛" thick. Figs. 4 and 5 show the method of fastening this loop to the boat.

No. 2 coil was also similar in shape to No. 1, but was wound with wire consisting of 18 strands of No. 26 copper wire covered with a ⅛" rubber covering with an additional impregnated hard, varnished cambric insulation.

No. 3 coil was wound as shown in blueprint radio No. 788. The keel formed half the coil circuit in this case. The same wire was used as with coil No. 2.

The use as a part of the loop of the metallic keel in contact with the water, involves the same principle as the use of the metallic hull of a submarine as part of a loop for both transmitting and receiving, as developed by the Bureau of Standards several years ago.

EXPERIMENTS ON COIL AERIALS

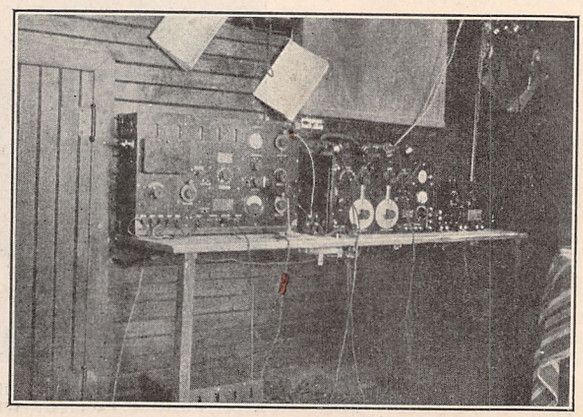
Experiments on the three coils described above showed that No. 3 was not quite as good as the full turn of wire, but the difference was so small that where the keel could be used it would be preferable to do so. The coil current was 0.6 ampere. There was very little difference between Nos. 1 and 2.

A coil placed horizontally on the boat was also tried out but proved unsatisfactory. The same was true in the case of a 2-turn vertical loop which was also tried.

During the tests it was found that the received signal strength varied slightly, depending upon whether the boat was headed away from or headed towards the receiving station. This slight uni-directional transmission effect, although not objectionable, was worthy of note, however.

It was also found that the coil had the ordinary maximum-minimum characteristic, for as the boat was turned in a circle the

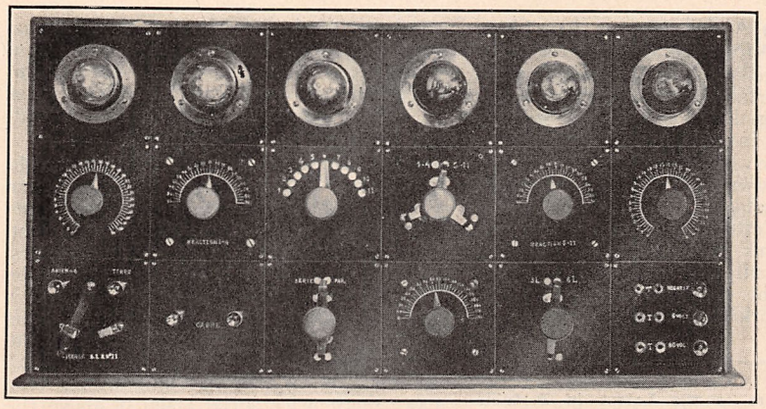
(*Continued on page 785*)



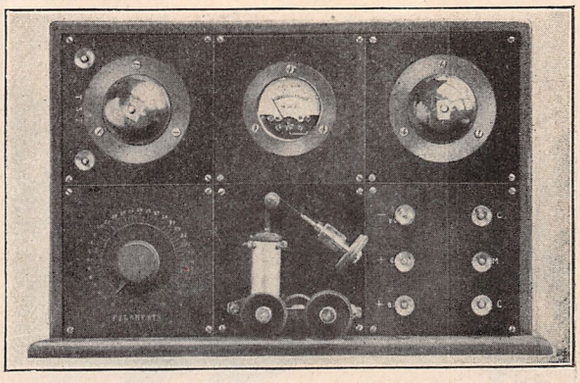
The Shore Radiophone Station Used in the Tests Carried on at Atlantic City Between a Lifeboat and the Shore.

**Associate Physicist, Bureau of Standards.*

New Foreign Apparatus



This Very Complete Receiver With Radio and Audio Frequency Amplifier is Entirely Made With Unit Panels, Which Are Interchangeable.

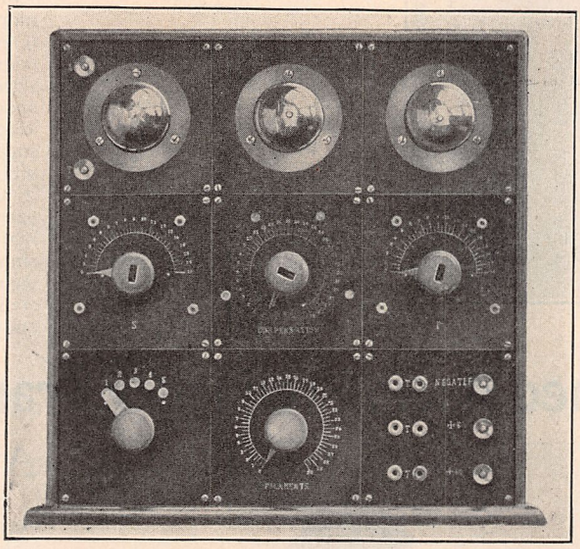


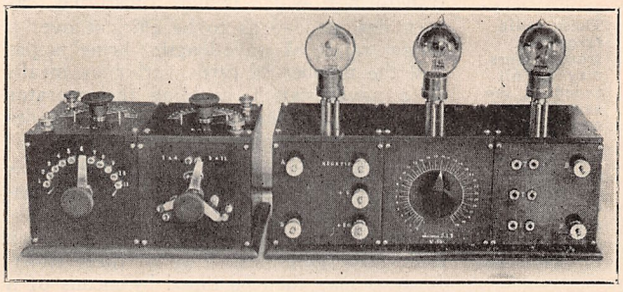
This "Very Low" Frequency Amplifier is Used to Operate a Morse Inker or Other Recording Apparatus.

AMATEUR radio is growing over in Europe and the number of amateurs is increasing rapidly, although they are only, at the present time, permitted to receive. Consequently, they can only listen to the Government and high-powered stations, copying the press and receiving time signals and other official information. In spite of the lack of radiophone broadcasting stations, more people are interested every day in amateur radio and the manufacturers of radio apparatus have improved their instruments in design and appearance so as to put on the market real scientific instruments of high standard.

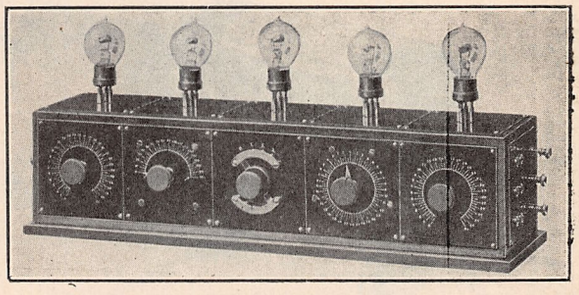
The photographs here shown represent the latest in amateur receiving instruments. These were designed by a Belgian house and are made of Unit panels that may be assembled by the amateur himself to form any combination of receiver or amplifier, or of both. Most of the European manufacturers have developed apparatus to be used with a loop aerial and in almost all of them, some sort of radio frequency amplification, either resistance or transformer coupler is used.

The eighteen-panel set, shown in one of the photographs, is to be used in conjunction with the loop aerial and includes three stages of radio, detector and two stages of audio frequency amplification. This system of construction enables the amateurs to make any type of receiver by using the proper panels upon which are mounted the various parts used in the construction of such apparatus. The cabinets, especially made for any number of units are built so that the panels are merely screwed on a framework supporting the whole thing.





Above is a detector and two-stage audio frequency amplifier built with the unit panels. On the left is a complete receiver with detector and amplifier. On the right is a four-step radio frequency amplifier and detector to be used with a loop aerial.



Magnetic Modulator for Radio Telephony

ONE of the most important inventions brought forth in the field of amateur radio telephony during the past year is the magnetic modulator. This development has resulted from the experiments of an eastern radio company with the Alexanderson magnetic amplifier, a device which is used at high-power trans-Oceanic stations to control the output of 200-K.W. radio frequency alternators. The same fundamental principle has been adopted in the three magnetic modulators herewith described, and for the first time the amateur experimenter has at his disposal a simple, yet thoroughly reliable, means of modulating the antenna oscillations of any low-power vacuum tube radio telephone set.

Once connected to a radio telephone set, these modulators require no further adjustment or attention. This assures the experimenter that at all times he is obtaining the best possible results from his apparatus. It makes possible practical and reliable radio telephone transmission from a tube transmitter even on the part of an experimenter having a very limited knowledge of radio telephone operation.

With This Apparatus Built on the Principle of the Alexanderson Modulator, Any C.W. Set May be Transformed Into a Phone Transmitter..

The magnetic modulator is a device which utilizes the properties of iron at radio frequencies to control or modulate the output of an oscillating vacuum tube or any other undamped wave generator. It is the result of a number of years of research and development work on the part of two of the country's largest radio and electrical concerns. The device is extremely simple in nature as well as in operation. It simply acts as a variable resistance connected in series with the antenna circuit (preferably the ground lead) of any high frequency oscillating system.

The great advantage of the magnetic modulator over other methods of modulation is that it gives the best and only non-

(*Continued on page 783*)

Radio on the Ranch

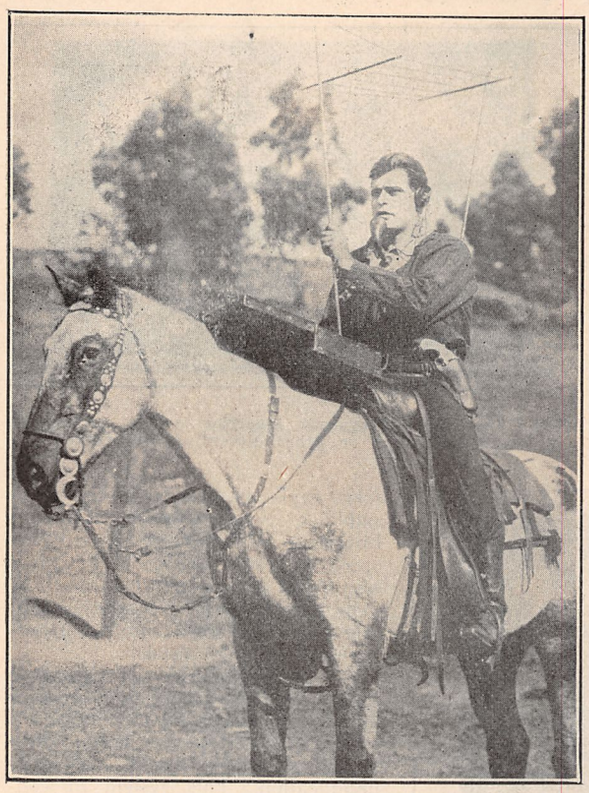


Photo © by International.

Here is the Latest in Portable Stations, the "Cow-boy Type" Radiophone With Which He Can Keep in Touch With the Ranch.

RADIO stations have been installed aboard all sorts of crafts; the amateurs made portable sets to be carried during their vacations on bicycles, or in small cases; the latest is the horseback Radio Station shown in the accompanying photograph and used in the West by a Radio enthusiast. This Radio man designed a small telephone set, using one tube supplied by batteries and working on a very short aerial.

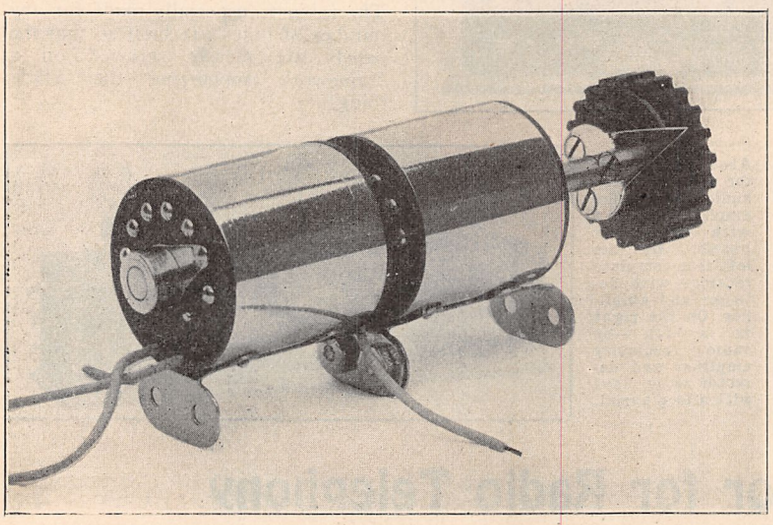
The set in itself is complete and includes a tuner for receiving, the same tube being used as a detector and an oscillator, for receiving and transmitting.

The difficult part of the experiment consisted in making the set radiate enough energy on a very small aerial; various systems were tried and good results were obtained with an ordinary aerial and a ground consisting of the horse's shoe, as shown on the front cover of this magazine. Condenser aerials were also tried successfully; the aerial consisting of a piece of wire gauze and the counterpoise, placed under the saddle, made of the same material.

Good telephonic communications were obtained over short ranges and it has been found possible to develop a small radio set that could be used by ranchmen when out, to keep in touch with their range-houses. Of course, with the type of aerial to be used in conjunction with these sets, it is necessary to use short wave-lengths; this is not an impossibility, as during the late war several trench sets were designed along this line, one of these working with a very short single wire aerial about 6′ above the ground, on a wave-length of 80 meters.

If made simple enough to operate, and fool-proof, Radiophone sets would be used more on the farms, as in some cases there is no direct communication from isolated points to the nearest town. A properly designed instrument operated by a single switch to start or stop it, could be used to keep in touch with the nearest place where supplies may be obtained, and would save much time and trouble. A little while ago it would have been difficult to sell such apparatus to the farmers, for they did not know how useful a Radio set could be, but since several now operate receiving sets, it would be much easier to introduce, as a new convenience and time saver, Radio telephony among them.

A New Tuned Radio Frequency Transformer



These radio frequency transformers may be all tuned at the same time by means of a single knob, thanks to a special mounting and coupling shaft.

AS is well known, a radio frequency transformer, unless a means of tuning is provided, has a rather poor efficiency outside of the band of wave-lengths for which it is designed. The radio frequency transformer, which is here illustrated, has been designed so as to be efficient over a longer range of wave-lengths, being tapped and the number of turns varied by means of a novel switch, enabling the operator to quickly tune the transformer for the desired range of wave-length.

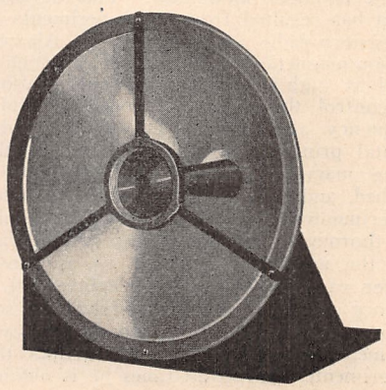
A clever feature of this instrument is the method of mounting, which automatically couples the tuning switch of a transformer, when coupled to another, in a multi-stage amplifier. Two or three transformers may then be tuned by means of a single knob, as may be seen in the photograph showing two transformers assembled, and simplifying the tuning for the quick picking up of a station.

The Amplitron Loud Talker

RADIO manufacturers all over the country have been devoting a great deal of time, money and thought in the past few months to the development of a suitable loud talker for radio reception that would meet all the requirements of similar high priced instruments and at the same time be within reach of the pocketbook of everyone. In this endeavor, an Eastern radio manufacturer seems to have been successful. This manufacturer has just announced the placing on the market of the "Amplitron." As may be noticed from the reproduction herewith, this instrument, of a novel design, seems to have incorporated all these, so important to radio reception. So simple in design is it that one wonders why such a contrivance has not been designed long before this, but at the same time theoretically constructed to meet the requirements of its numerous duties.

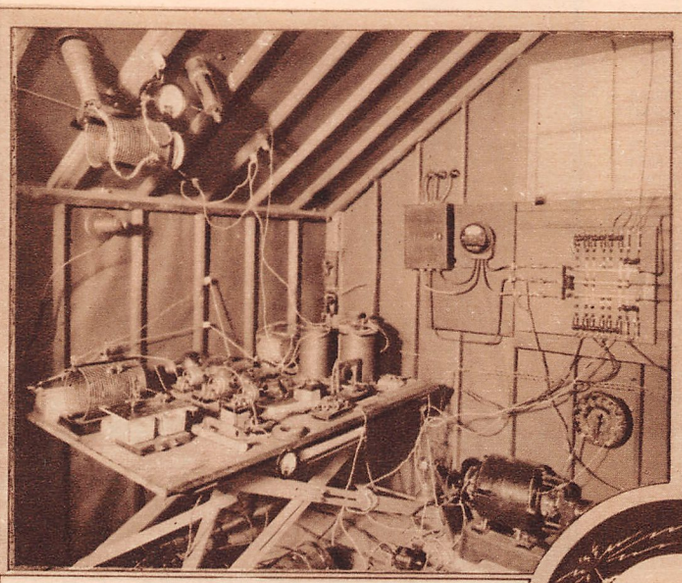
No batteries are required for its use; a Baldwin phone is simply screwed into place and the instrument is ready for use. Its lightness of weight, permitting its frequent removals at will, and its small dimensions make it especially convenient for home use.

This Conical Sound Reflector Works Very Efficiently with a Baldwin Phone, Type C, and Gives Good Loud Signals Without Distortion. An Important Feature in Speech Amplification.

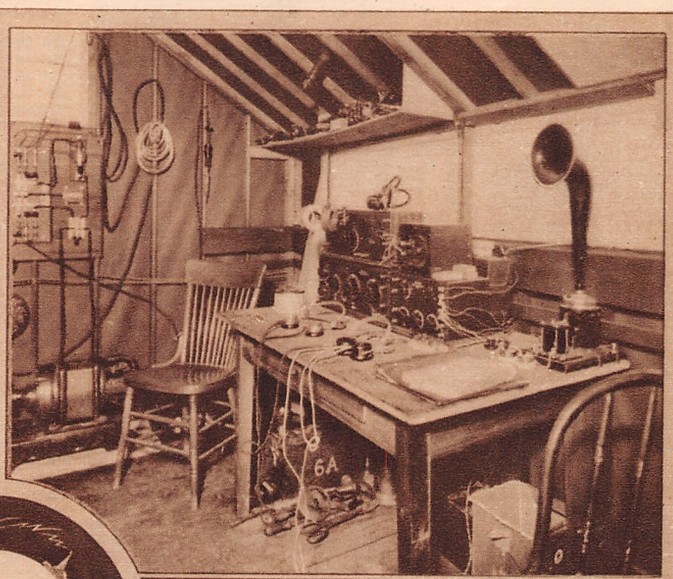


Amateurs Span the Atlantic

As reported by PIERRE BOUCHERON



Above is the Transmitter at 1BCG. It Consists of Four 250-Watt Tubes Hooked up as Shown by the Diagram on This Page. The Radiation in the Aerials Was About Six Amperes.



The Long and Short Wave Receivers and Amplifier of 1BCG Hooked up to a Special Aerial. This Set Was Especially Used to Listen to the Messages From Mr. P. F. Godley, Sent by MUU Everyday.

THE Continuous Wave method of transmission has conclusively won its laurels for twenty (20) of the twenty - five (25) identified American amateur radio stations heard by Paul Godley, official observer of the American Radio Relay League stationed at Ardrossan, Scotland, between December 7 and 16, were found, upon verification to have been C.W., the annihilator of long distances. Five of the stations were successful in crossing while using the older spark method.

Here are the stations who successfully competed:

1AWW—Illegal station, not identified.

1ARY—C.W. and spark—University of Vermont, Burlington, Vt.

1BDT—C.W. and spark—S. S. Heap, 132 Atlantic St., Atlantic, Mass.

2BK—Spark only—C. E. Trube, 6 Livingston Ave., Yonkers, N. Y.

2DN—Spark only—Arnold Brilhart, 10 Cornell Ave., Yonkers, N. Y.

2EL — Freeport, L. I.

3BP—Spark only—E. S. Rogers, Newmarket, Ontario, Canada.

1BCG—C.W.—Armstrong — Cronkhite — Amy — Grinan — Burghard — Inman Station, Greenwich, Conn.

1BGF — C.W. — Perry Briggs, 52 Gerard St., Hartford, Conn.

1RU—C.W.—R. S. Miner, 68 Quaker Lane, Hartford, Conn.

1RZ—C.W.—J. W. Hubbard, Ridgefield, Conn.

1XM — C.W. — Mass. Institute of Technology, Cambridge, Mass.

1YK—C.W.—Worcester Polytechnic Institute, Worcester, Mass.

1BKA—C.W.—J. E. Brown, Glenbrook, Conn.

2EH—C.W.—Radio Engineers' Club, Riverhead, L. I.

2FD—C.W.—J. DiBlasi, New York, N. Y.

2FP—C.W.—H. Barber, 252 Neptune Ave., Brooklyn, N. Y.

2AJW—C.W.—H. S. Collins, Babylon, L. I.

2ARY—C.W.—W. E Redfern, 2249 82nd St., Brooklyn, N. Y.

2BML—C.W.—H. H. Beverage, Riverhead, L. I.

3DH—C.W.—D. W Richardson, Princeton University, Princeton, N. J.

3FB—C.W.—W. Jordan, 3d, Atlantic City, N. J.

8BU—C.W.—J. Russell, 1941 East 83d St., Cleveland, O.

8XV—C.W.—F. S. McCullough, 126 Lincoln St., Edgewood, Pittsburgh, Pa.

8ACF—C.W.—T. McNeary, Washington, Pa.

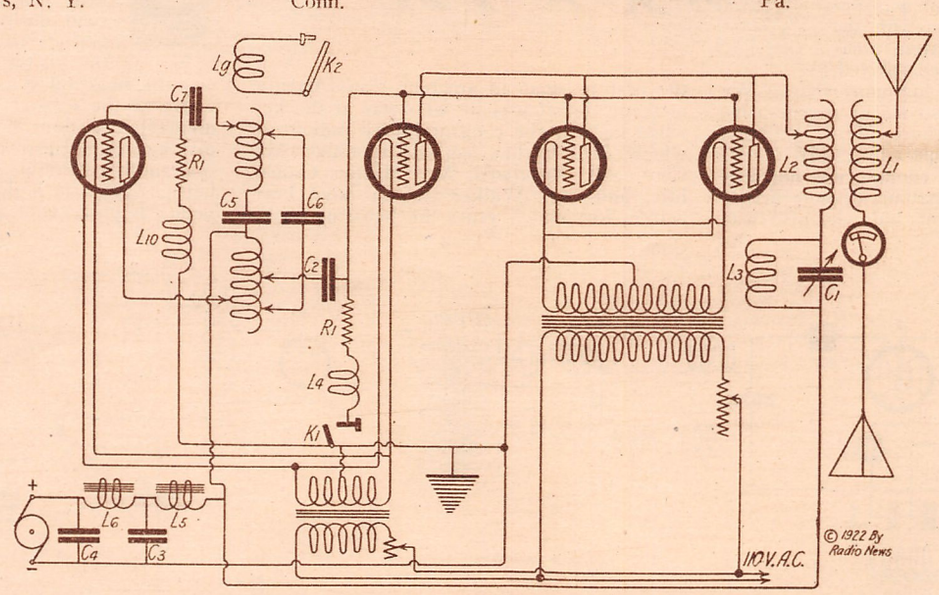
The first amateur radiogram to be sent from the United States and to be received in Scotland during the great test is as follows:

"1—1BCG wds 12 New York date

To Paul Godley

Ardrossan Scotland

Hearty Congratulations, Burghard—Inman —Grinan—Armstrong—Amy—Cronkhite."

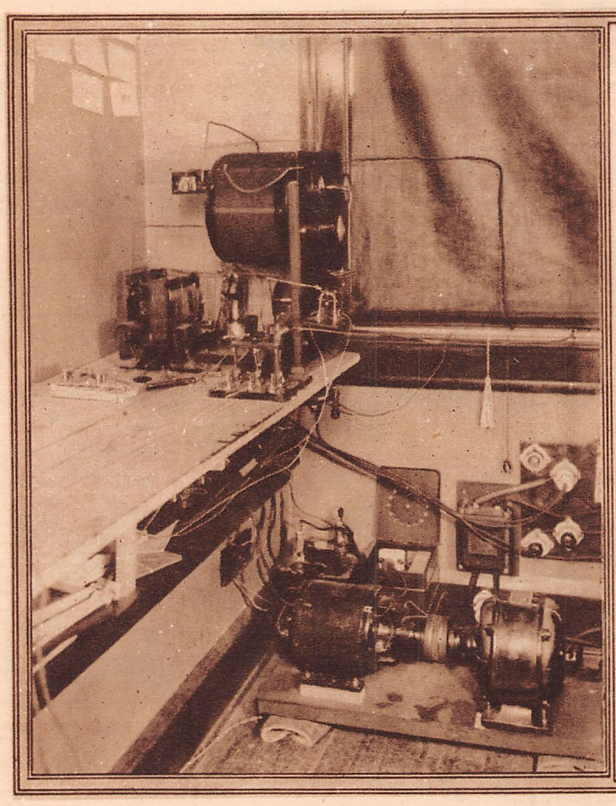


Hook-up of 1BCG Transmitter, With Constants of the Circuit. C1=.004 M.F.; C2=.002 M.F.; C3=.25 M.F.; C4=.0017 M.F.; C5=.25 M.F.; C6=.001 M.F.; C7= .002 M.F.; R1=2,500 Ohms; R2=10,000 Ohms; L1=5½ Turns; L2=36 Turns; L3 and L4=3 Millihenries; L5 and L6=9 Henries; L7=16 Turns; L8=3 Turns; L9=3 Turns; L10=3 Mil.

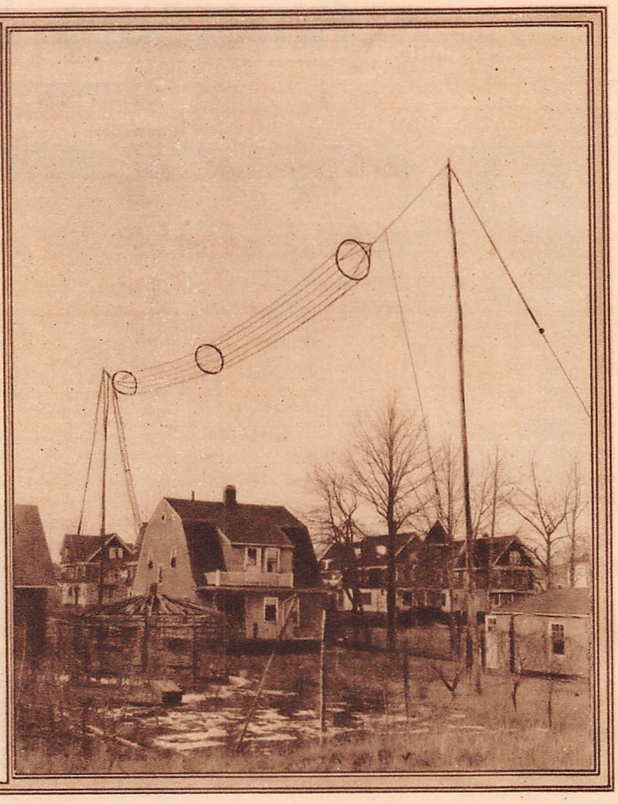
At the receiving end it is understood that Mr. Godley, while at Ardrossan, Scotland, employed a regenerative and a super-heterodyne receiver in conjunction with a so-called wave antenna consisting of a single wire 1,200' long and 12' high erected on poles over swampy ground.

It is perhaps not untimely to mention the first British amateur to copy an American colleague during the test period. He is A. G. Greenlade, 9 Jelf Road, Brixton, S.W. 2, London, England, who copied 1BCG for a period of two hours on Sunday, December 11.

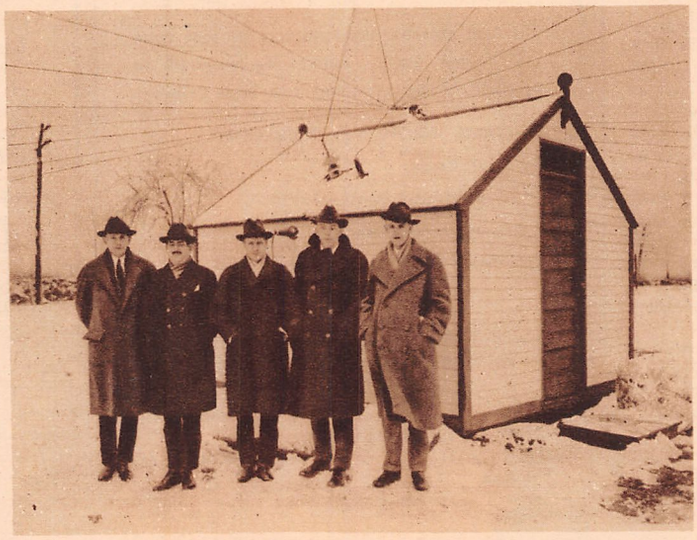
In looking over the list of American



On the left may be seen the transmitter of 1RU using a single 50-watt tube in the circuit shown on page 699; on the right is the cage aerial of this station. The photograph below is that of the operators at 1BCG in front of the 'radio shack". From left to right are Messrs. E. V. Amy, J. F. Grinan, George E. Burghard, E. H. Armstrong and Minton Cronkhite; note the counterpoise and lead in.

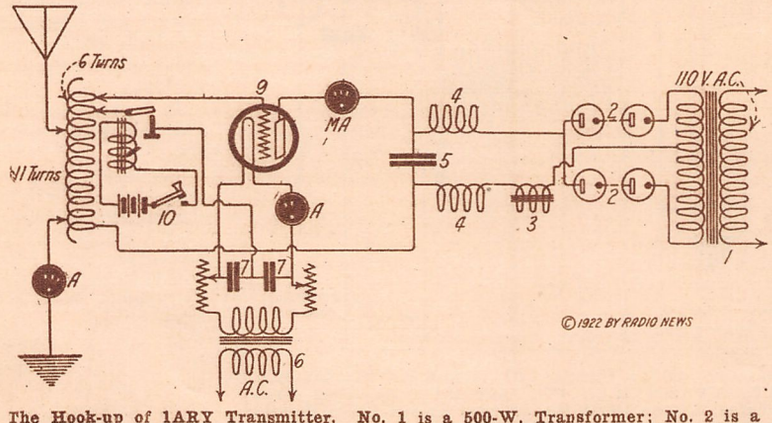


amateurs who "carried" across, we note many well-known names, several of whom have already distinguished themselves in other ways. For instance, and although Mr. Godley tells us that he heard an unidentified call of 1AWW on the night of the 7th, we are advised that the first identified call was that of 1BCG at Greenwich, Conn., which Mr. Godley first heard "strong and steady" for four hours on the night of the 9th between 7 P. M. and 1:35 A. M. as well as on other succeeding days.

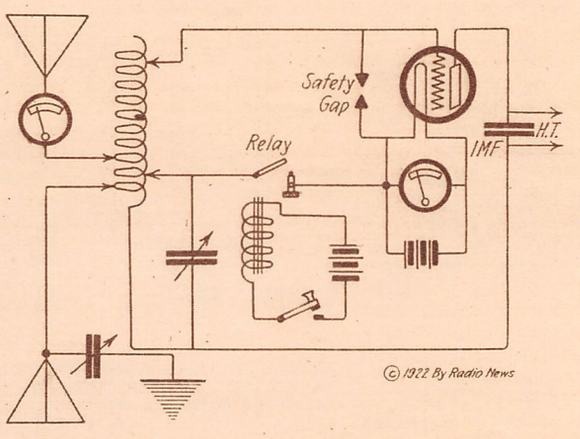


1BCG presents some interesting facts. It is located on the Clapp Board Ridge Road of Greenwich, Conn., and was somewhat hurriedly erected especially to compete in the trans-Atlantic tests. It is owned and was operated jointly by some of the East's most representative amateurs who have worked, played, eaten and talked radio for many years. We have Major E. H. Armstrong of regenerative and super-heterodyne fame; Mr. E. V. Amy, short-wave antenna specialist; Mr. J. F. Grinan, who strangely enough, was not only the first to send an amateur message across the American Continent, but who also was the first to send an amateur trans-Atlantic message, for it was he who was at the key when he sent the congratulatory radiogram which Mr. Godley copied in toto. Mr. George E. Burghard, Mr. Minton Cronkhite, and Mr. Walker Inman have been active for many years in boosting radio through the Radio Club of America.

The station has been erected on an exceptionally ideal plot of ground. Approaching the unique cage aerial, counterpoise system and the two tall masts with the bleak Connecticut landscape as a background, these tend to impress one with that touch of romance connected with private individuals engaged in amateur trans-Atlantic communication. It is then perhaps that we get a flash as to what it is that causes thousands of men throughout the United States to forsake all other pastimes for the wiles of radio. Here we have six men who spent the best part of two weeks without sleep, and very little food in a forsaken little shack far from the main road during one of the coldest periods of the winter. Indeed, the visitor wondered whether it was the small oil stove which kept the room warm or the natural warmth of the six individuals crouching here and there, one now making an adjustment, another telegraphing, another drinking coffee from a thermos bottle. What is it that makes old men and young boys crave for radio? Surely it is



The Hook-up of 1ARY Transmitter. No. 1 is a 500-W. Transformer; No. 2 is a 40 Test Tube Rectifier; No. 3, a Choke Coil of 1,500 Turns on Open Core; No. 4, an 1,250 Honeycomb Coil; No. 5, a .008 M.F. Condenser; No. 6, a Filament Transformer; No. 7 Are .0017 M.F. Condensers; No. 8, an Inductance 9" in Diameter; Wound With No. 4 Copper Wire, ¾" Between Turns; No. 9, a 50-Watt Tube; and No. 10 is the Relay and Key.



Hook-up of 8BU Using a 50-Watt Tube With 1,000 Volts Furnished by a Transformer and Rectifier.

not the lure of gold, for there is little enough of that. Is it, as it was in the case of the operating staff of 1BCG, that the prospect of many long nights of vigil, sending and listening in, appeals to their particular idea of a good time? The casual observer will swear to you by all the stars of the first magnitude that "there is no fun in this." We came to the conclusion, therefore, that it must be the insidious bite of the radio bug.

The signal success of this latest of amateur undertakings was hardly expected by many prominent radio men. Indeed, the writer well remembers the doubtful Thomases who gathered at the pier to see Mr. Godley off on his way to England. Some thought that possibly one or two calls would be heard under exceptional atmospheric conditions, but never did anyone think so many would be heard in so short a time. From the ease with which Mr. Godley copied American amateurs it would seem that a bright future is in store for international radio amateurism, with C.W. transmission and regenerative reception playing leading rôles.

And now for a few remarks upon the sort of apparatus some of the successful ones used at their stations.

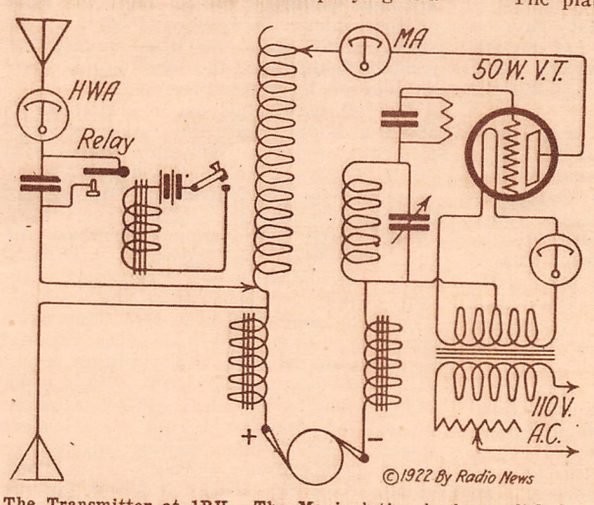
In the case of 1BCG, a "T" cage flat-top antenna, 100′ long with a 70′ vertical cage lead-in, supported by a 100′ mast on one end and an 80′ mast on the other was employed. A radial counterpoise 120′ in diameter spreads out fan-like from the top of the shack.

The transmitter circuit consists in the main of four radiotrons U.V. 204, the 250-watt tubes, one of which acted as a master oscillator and the other three as amplifiers. The plate current was supplied by a 2000-volt D.C. generator, and filament current was supplied by an A.C. step down transformer with R.C.A. inductances and grid leaks. The set was keyed in the grid leak for straight C.W. and with a chopper for I.C.W. The total input to the plates of the four tubes was 989 watts. The radiation at this input was six amperes with a total operating efficiency of about 52 per cent, or approximately 558 watts of energy in the antenna, the exact length of the emitted wave at 1BCG being 230 meters.

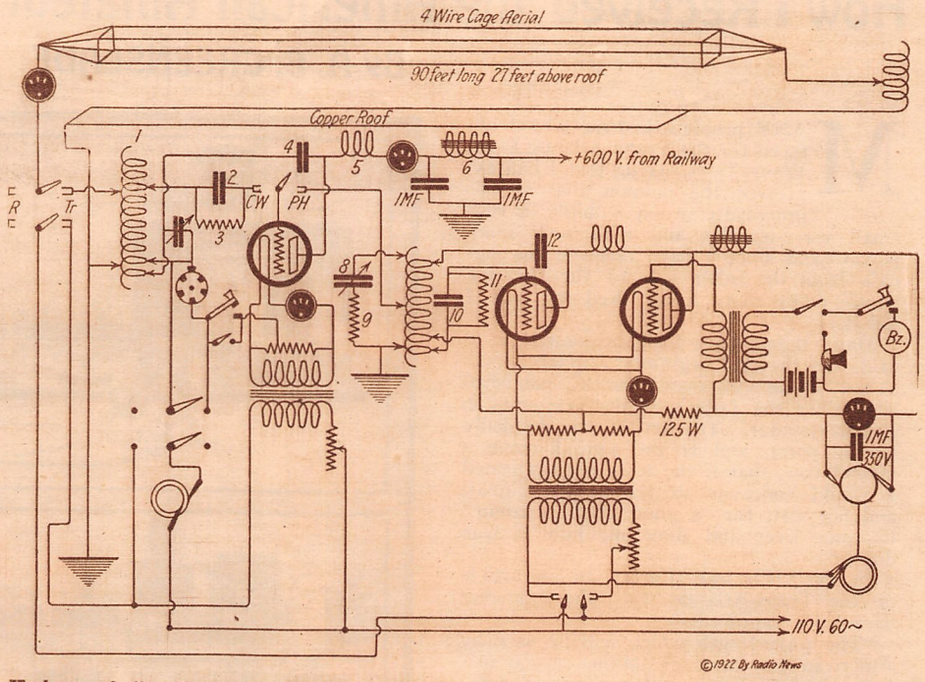
The "carrying" qualities of 1BCG is demonstrated by a report just received from an American ship operator who, while docked at Hamburg, Germany, copied the station's test calls and radiograms to British amateurs on several days of the test.

Then we have a few interesting and timely remarks from 1RU of Hartford, Conn., who says among other things:

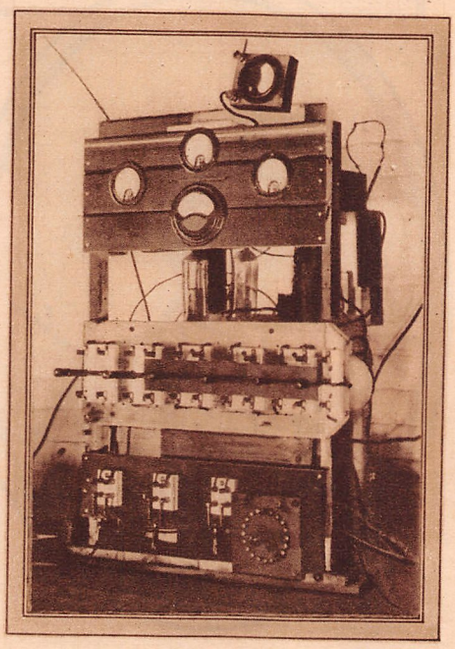
"The Stanley circuit was used and if you will refer to the accompanying diagram and code I will try to give you a complete description.



The Transmitter at 1RU. The Manipulation is Accomplished by Shorting a Series Condenser in the Aerial.



Hook-up of the Temporary Master Oscillator System Used by 1YK, the Worcester Polytechnic Institute.



"The plate voltage was 1350 D.C., plate current 220 milliamperes, and the antenna current four amperes. While these figures indicate a much overloaded tube, the plate temperature was low, and it is the writer's opinion that the tube was well within its possibilities.

"I have experimented with many circuits and tubes in the past two years but this combination gives by far the best results.

"1RU has been reported QSA by stations in Dublin, Texas, Alexandria, La., Nashville, Tenn., Jacksonville, Fla., Topeka, Kan., Clinton, Iowa, Northfield, Minn., Louisville, Ky., and all through Ohio, Illinois, Indiana, Wisconsin, etc., etc. I have no trouble working 4BY in Savannah with an antenna current of only 2½ amperes, and I have only one report noting bad QSS."

1BDT is owned and operated by Sheldon S. Heap who writes:

"I understand from reports sent back from Scotland that I was heard on the night of December 11 at 8.30 P.M. The reports say that I was heard while using both spark and C.W. I was testing with both sets at about this time.

"For C.W. I am using one U.V. 202, 5-watt Radiotron with 400 volts of rectified A.C.

"The transformer and inductance are of my own design and make. The radiation was approximately .8 ampere. My spark station is of the usual type, with Acme transformer using about 700 watts input, 16 stud rotary running at synchronous speed at 1800 series parallel glass plate condenser. It has been my aim to cut down resistance in all of my apparatus, and all high frequency wires are very large. My antenna is 90′ high at one end and 60′ at low end with 65′ flat top, 20′ spreaders with seven wires and a cage lead-in. The counterpoise is about 8′ high, having 18 wires in a fan shape. I think most of my success is due to this antenna system and close tuning at 200 meters."

Using a rather simple single inductance circuit which is shown herewith, J. R. Russell, formerly 8BU, tells us:

"In addition to being heard in Scotland, I have been heard numerous times all over the East and as far West as Lincoln, Nebraska, as far South as Houston, Texas, and as far East as Hartford, Connecticut.

"My transmitting set consists of the following apparatus, one U.V.-203 (50-Watt) tube with socket to fit, rheostat, grid leak and grid condenser, chopper, Jewell O-5, thermo coupled radio frequency meter, oil variable condenser, and home-made 1250-volt plate transformer; a 32-jar four-element rectifier (8 jars to the element), relay, and storage cells for the filament. Helix consists of 45 turns of No. 4 stranded copper wire wound on a 3″ bakelite tube.

"The outside elements consists of a four-wire inverted "L" aerial, counterpoise, and ground system. The ground is coupled to the counterpoise through a Murdock 43-plate variable condenser filled with olive oil. Radiation in aerial circuit is four and two-tenths amperes. On aerial and counterpoise only the radiation is two and nine-tenths amperes. By hooking ground to

(*Continued on page 769*)

How I Received the American Amateur Stations in England

By A. E. GREENSLADE

MANY people asked me why I entered for the Trans-Atlantic Short Wave Tests, seeing that I had expressed the opinion that it was practically an impossibility on such small wave-lengths, and with such small power—and since I have received the signals from the other side of the "herring pond" many more have asked me how I did it.

Many things have little beginnings, it is said, and the real beginning was an article I saw in an American journal, published soon after the failure of the first tests in February, 1921. The article was decidedly to the point, and at the time I made a mental vow, that if the tests were repeated I would endeavor to receive the signals and not wait for "a good U. S. amateur" to come over and show me how it was done.

In the *"Wireless World,"* in an article on the Trans-Atlantic tests, the following paragraph appeared:—

"The wave-length which will be used by American transmitting stations is 200 meters and the power will not exceed 1,000 watts. It is to be expected that there may be some slight divergence from the exact wave-length, but this is unlikely to exceed about 15 meters either way."

With this paragraph in mind I decided to construct a set which would tune between the wave-lengths of 180 and 230 meters, and it was only 24 hours before the actual tests were timed to commence that I received official intimation that the wave-lengths were to go as high as 375 meters. Owing to this, and there being no time in which to make other gear to cover the whole range, my set was useless for about 50 per cent. of the tests.

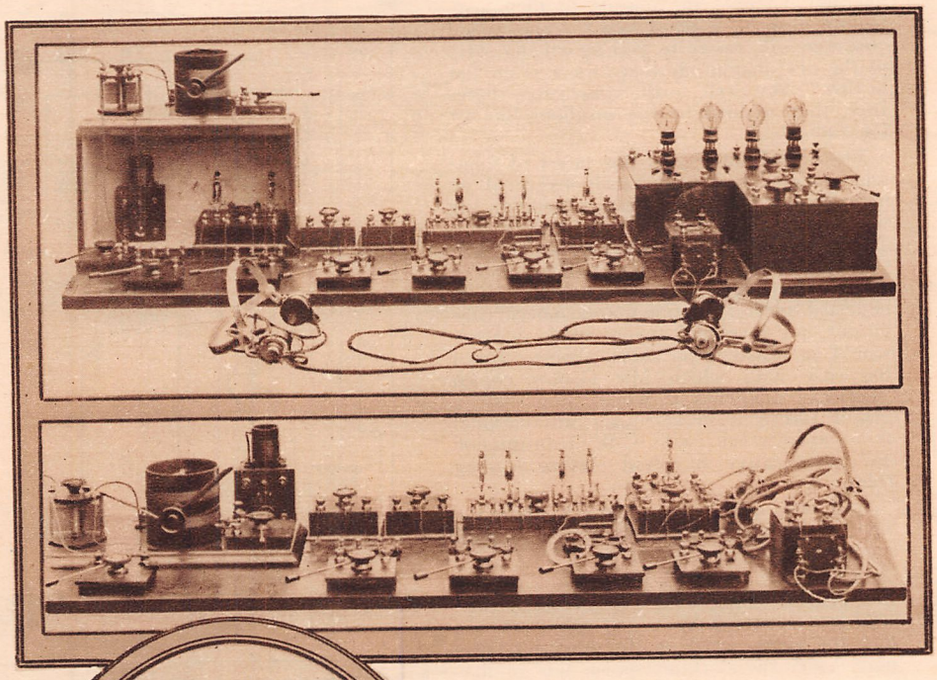
Owing to the interference caused by radiation from amateur aerials during the tests of February last, urgent appeal was made to those taking part in the reception tests to refrain from using a regenerative circuit and to use only separate oscillators.

The aerial, which, although of excellent construction, was abominably situated for a test of this description. It was entirely surrounded by trees and buildings and in close proximity to corrugated iron and lead roofs. To make matters worse it was practically at right angles to the direction desired (lying NNW by SSE). The photograph gives some idea of the formation of the aerial. The aerial, a twin inverted "L" type consisted of a 40′ horizontal portion and 30′ down lead. Height of horizontal portion 50′ from ground.

When you read these lines think of the English amateur and our red-tape control which limits us to 100′ of wire, if a single wire aerial, and a total length of 140′ if more than one wire be desired, and be thankful that you are in the States.

Also imagine, if you can, where the American amateur would be with a transmitting license for 10 watts (spark or C.W.) and then months of corresponding and filling out of documents before that is granted; in fact, you are fortunate if you get the permission eventually.

I decided to employ six stages of high frequency amplification using transformer coupling, the secondaries to be shunted with vernier condensers to obtain the necessary variation of wave-length. The transformers were wound and tested against a standard circuit especially designed for the purpose, which, with its shunted buzzer, is shown in the photograph. This little instrument was invaluable in the manufacture of the tuner and transformers, and throughout the actual tests themselves. Its signals were easily picked up, when placed under the aerial, a distance of 50′, which, seeing that it was a closed oscillating circuit, and therefore a bad radiator, proved the efficiency of the receiving gear.



The Above Photographs Show the Station Installed by Mr. A. E. Greenslade, an English Amateur for the Transatlantic Tests. Above is the Former Station, Consisting of Six Stages of Radio Frequency, Detector and Four Stages of Audio Frequency Amplification. Below is the Reduced Set Consisting of Four Stages of Radio Frequency Amplification and Detector With Which Signals From 1BCG and 1RU Were Received.

The transformers upon test gave a wave-length range from 182-228 meters which was considered sufficient to allow for any discrepancy in tuning by the transmitting stations.

I am of the opinion that many more stations would have been received if only the particulars had come to hand in time to prepare a further set of transformers with which to cover the complete range of wave-lengths transmitted. Towards the end of the tests the schedule showed practically all transmissions on wave-lengths over 200 meters, poor consolation to one restricted to the range mentioned above. It was simply a case of close down.

The tuner consisted of a primary winding wound upon a spherical former capable of rotation within an ebonite tube, through an angle of 90 degrees for coupling purposes. In series with this primary was connected a variable condenser (air di-electric) of .0005 mf. capacity and to obtain a delicate adjustment of tuning a vernier condenser was connected in parallel.

The secondary winding was wound upon the ebonite tube containing the primary former, and was tested and gave a range from 180-230 meters when connected to a vernier condenser. All controls were made by handles six inches in length to avoid the capacity effect of the hand when tuning.

A potentiometer was used to control the grids of the six high frequency valves. A Marconi "Q" valve was used for rectifying in conjunction with a potentiometer. During the tests a Marconi V 24 valve, together with a grid condenser and leak, was tried but discarded in favour of the "Q." The "Q" valve was mounted upon a separate panel (see photograph) and supplied with separate L.T. and H.T. batteries. Four stages of L.F. amplification were arranged in such a manner that two, three or four valves could be switched in as desired. This with the usual accessories completed the set; the photograph gives an idea of its appearance.

The set was completed on December 6, about 36 hours before the tests were timed to begin, and the calibration waves sent out by Messrs. Burnham & Co. and Messrs. Marconi Scientific Instrument Co., received on that evening gave great hopes.

Soon after the commencement of the tests, the first two stages of high frequency amplification were discarded, difficulty being experienced in the control. The L.F. amplifier was also laid aside for it was discovered that when switched in the noises from the A.C. lighting mains, etc., would not allow of weak signals being read through the amplification of these noises, but lounder signals were exceptionally good, the signals themselves drowning the other noises. After these modifications the set as it stood for the

(*Continued on page 762*)

Some Practical Points on Arc Operation

By JOHN F. BRONT

THE other day a man came to me and said, "My chopper doesn't work well and I can't get a good note from it because the wire in the antenna is too large to radiate a musical note."

In a couple of paragraphs I want to run over just a few points on the operation of the chopper such as that type employed on the Federal 2-K.W. set which is used aboard merchant ships and in some cases abroad men o' war. (It is sincerely hoped that we may be able to delete this latter statement through the good offices of the men who are now at the Washington Conference and turn the wonderful assets of radio science to the pursuits of peace, where its usefulness will fit more into our daily lives and the work-a-day of industry rather than the destruction of industry through such altercations as the late war which we all hope is the last one.)

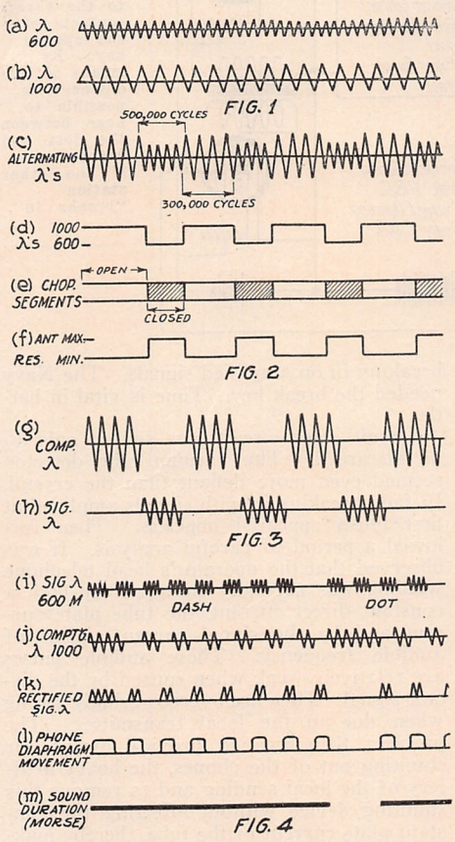
The successful operation of the chopper appears to be rather much of a stumbling block for a number of men, especially in the mechant service of the United States where there are quite a considerable number of the Federal type instruments employed for ship to ship and ship to shore communication.

Essentially for such inter-communication, the apparatus which may be quickly started into operation is highly desirable, and if the arc apparatus is properly handled, the same results and speed of operation, and change from sending to receiving and vice versa may be accomplished, and is possible with the ordinary spark set. In fact, there is possible a higher speed in "changing over" with the arc type than is possible with some of the old spark transmitters where in those installations the operator has no distant control of the motor-generator unit, and which latter is installed in the radio cabin. Necessarily, before being able to receive, the operator must wait until the dynamic brake of the machine has brought it to rest before signals from a corresponding station are at all audible or intelligible in fast work. Even though the converter must be shut down before reception, the period required for restarting the apparatus takes but a moment, even though the arc main, the starting resistance switch, the aerial change-over switch, the hydrocarbon supply, and the re-adjustment of the arc length must be made quickly and in a certain order, which cannot be departed from.

In order to obtain a clear musical note from the chopper, certain precautions must be kept in mind, and the adjustment of the converter to radiate a clear sharp musical note is a much simpler operation than the adjustment of a 500-cycle spark set with impact excitation. Primarily the emission must be clear and smooth, and the arc current as shown on the D.C. line must be steady. Unless the C.W. note of the set is clear and smooth, there is no possibility under the sun of obtaining a clear note from the chopper after it has been placed in operation. If the C.W. note is ragged and "scraggly," the chopper functions just the same as at a time when the emission is clear, that is, it continues at its specified duty of breaking up the antenna current, frequency and wave-length, yet to obtain a clear chopper note, the C.W. emission itself must be clear.

In order to obtain a clear C.W. emission, there are many points which must be carefully taken care of. The arc must be adjusted to a steep point on its characteristic curve, the anode must be properly cooled, the arc length must be adjusted to an exact value, the supply of hydrocarbon base must be sufficient, the voltage must be a certain value for a given arc length, the chopper commutator when employed must be clean and dry. These factors entail some intricate knowledge of the actual operations going on in the converter during the production of radio frequencies, for best results.

It has been maintained by some that the speed of the chopper must be finely adjusted. This is not so, under certain conditions, as far as rendering an intelligible note is concerned. As will be made quite obvious from some later details, the chopper



This Diagram Shows the Variations of Amplitude of the C.W. During the Working and Rest Periods, as Well as the Resulting Telephone Current in the Receiver.

will produce a musical note over a wide range of speed if the smooth and efficient operation of the arc is attended to with intelligence and care.

Regarding this efficient operation of the converter, let us run over a few points which are vital to operation. The action of the magnetic blast, the hydrocarbon supply, and the cooling of the electrodes are closely interlinked, and the irregular operation of the converter in most cases can be traced directly to the failure of one, two or the three of these most important items.

The magnetic field blast is of definite purpose. In modern practice, the lines of force of the magnetic circuit are projected across the arc gap by means of magnet poles thrust into the chamber walls in close proximity to the arc flame. There are two chief purposes achieved. First the arc flame is stretched and the operation made more unstable. The blast serves to disrupt the arc flame with great suddenness, which is desirable. Secondly, the blast blows out a good portion of the ionized particles in the arc gap. During the passage of current, ions are formed in the gap and, being absorbers of energy, greatly reduce the resistance of the gap at a time when it is most desired that the gap be quickly and efficiently restored to a state of very high resistance. The resistance of the arc gap follows a peculiar curve. At the time when the maximum of current is crossing the gap (the combined condenser (antenna capacity) current and the regular arc current), the resistance of the gap is at a minimum, and the potential is at a minimum, and the current is at a maximum. At the point where there is the greatest fluctuations of these values, there is the point where the production of radio frequencies is most provident. All this has an important bearing on the production of a clear note by the chopper as well as the production of a smooth C.W. note when the latter is heterodyned.

At the time when the combined condenser and the "arc" current cross the gap, there is a great production of ions, as mentioned before. Due to these ions being present, the gap is not immediately restored to the desired state of high resistance after the passage of this heavy current. If the gap is not returned quickly to a state of high resistance, the potential across the gap will not be sufficient to render the charging of the condenser again at such a potential as to give appreciable current at the desired radio frequency. The blast assists in restoring the gap to high resistance by blowing out a goodly portion of these tiny absorbers of energy. With the quick restoration of the gap to high resistance stage, the frequency and amplitude of the oscillations are greatly enhanced as mentioned.

Directly in connection, is the function of the hydrocarbon base which under the intense heat of the arc flame is disintegrated and free hydrogen liberated. The main object of the utilization of hydrogen is the cooling effect upon the chamber and the rapid conduction of the heat away from the electrodes which also assists in restoring the gap to the state of high resistance in order to bring about the rapid recharging of the condenser.

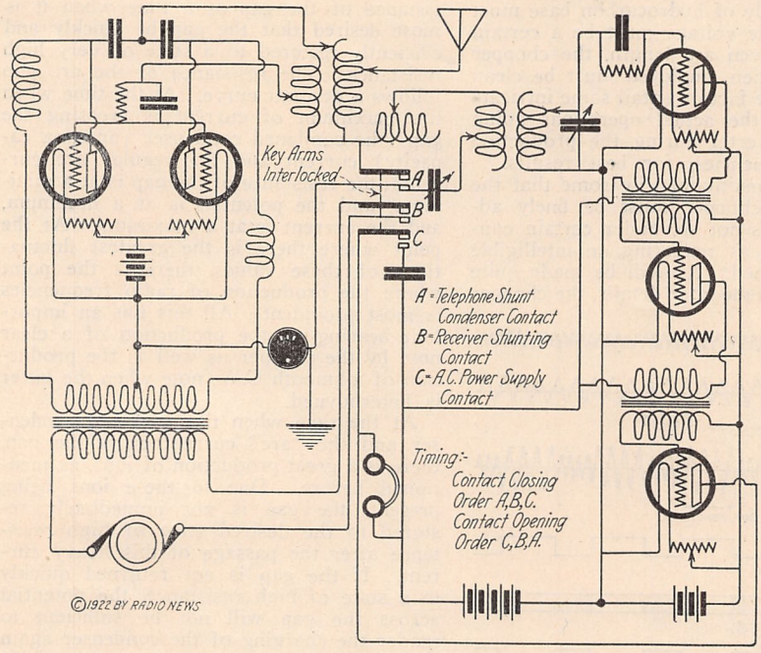
It follows that in considering the proper voltage across the gap as indicated by the D.C. voltmeter, all these items have a direct bearing upon correct value of the potential to be applied. The ions, the blast, the hydrocarbon disintegration, the cooling of the anode, all tend to effect the selection of a proper potential in order to place the maximum charge in the shunt condenser (antenna capacity) and produce radio frequencies of desirable amplitude and frequency. At best, the wave form is not sinusoidal, rather possessing fairly sharp maximums and an irregular amplitude curve connecting the maximums, although succeeding oscillations of this irregular form do follow each other in regular sequence and are of the same general conformity.

What bearing these points have on the production of a musical note from the chopper are rather obvious. We cannot take a 60-cycle note or one of irregular consistency and by means of an interrupter transform it into a 600-cycle note of smooth and persistent audibility. Neither can the chopper be employed to transform an irregular fluctuating C.W. wave form and produce a 600-cycle note. As was stated, the C.W. wave forms *must be regular* in sequence and the succeeding oscillations must conform to a common shape and frequency, although the curve need not be truly sinusoidal, as proven in the operation of the chopper under correct adjustment of

(*Continued on page* 745)

"Breaking in" with Amplified Signals

By H. R. MILLER and H. E. HALLBORG



In this complete hook-up of a C.W. transmitter and receiver with amplifier, are shown the connections to the three contacts of the special key. By means of this device it is possible to hear between the dots and dashes sent, if the other station "breaks in".

THE "Break Key" has been a by-word with the sea-going radio man from the days when wireless was symbolized by an antenna, a sending key and an open spark gap whose familiar staccato crackling reverberated throughout the ship announcing that a message was being sent. The early radio operator was commonly a graduate from the railroad, or commercial land wire telegraph staff. He was professionally a "brass pounder." He was the master of simplex, duplex and quadruplex. It is not to be wondered therefore that upon assuming wireless duties, he found it irksome to manually operate a switch from sending or receiving positions a score or more of time to clear away a few hundred words of traffic. He wanted the job done with the key alone, as was his custom on the wire. He wished to cut in when he dropped a questionable letter or two. He regularly told his superintendent his troubles each time the ship made port.

By the above psychological process, there came to be installed on board—break keys. They were complicated "gadgets," as he called them, with a multitude of levers, wires and contacts. He was instructed not to disturb the adjustment which had been carefully made by the company's engineers. He was assured it was all primed for service. And so he sailed to sea buoyant at his anticipated new freedom from pushing to send and to receive. He would try it at the first opportunity.

Then, alas, what a disappointment. The new time saver sputtered and flashed at the contacts. The noises it made in his telephones all but defied belief. In fact, he missed a few messages without getting any traffic off at all. When at last he returned to port, his radio set was operating in the old laborious way, but he said nothing to the superintendent. Briefly, he had shorted out the "gadget," and swallowed his disappointment.

This was the story of the "break key" in the hey-day of the crystal detector. With the advent of the vacuum tube detector and the multi-stage vacuum tube amplifier, "breaking-in" appeared even more hopeless.

It was at this stage that two radio engineers of the U. S. Navy Department, Messrs. H. R. Miller and H. E. Hallborg, began actively to tackle the problem of breaking in on amplified signals. The Navy needed the break key. Time is vital in battle.

Circuit after circuit was set up only to be discarded. The vacuum tube detector seemed even more defiant than the crystal. In fact, breaking in with signals amplified at first blush appeared hopeless. Then followed a period of careful analysis. It was observed that the operator's head telephone winding was normally energized by both a constant direct current, the tube plate current and by the signal current pulses of audible frequency. These audible pulses are relatively weak when caused by the distant signal. They are overpoweringly strong when due to the local transmitter. The problem then was to provide means for shunting out of the phones, the heavy artillery of the local sending and to remove this shunting device without affecting the constant plate current of the tube, thereby making the head phones immediately responsive for reception.

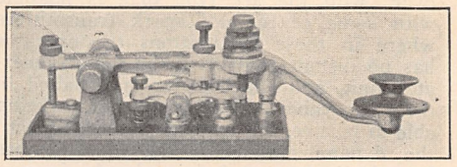
Fortunately the answer to this problem proved both simple and effective—a low reactance telephone shunting condenser. The normal pulse frequency of a signal is from 500 to 1,000 per second. A condenser of 2 mfds. capacity has a reactance at 500 cycles of 159 ohms. The reactance of a pair of head phones to this same frequency is about 22,000 ohms. Consequently, the condenser shunt robs the telephones of 99.3 per cent of its pulse current and renders even the powerful radiation of the local transmitter inaudible. At the same time the condenser shunt has no effect upon the steady plate current of the tube, since a capacity is an open circuit to direct current. The plate current is, therefore, susceptible to impression by the distant signal voltage immediately the local radiation is cut off and the telephone shunting condenser removed. Reduction of the telephone shunt capacity value permits the operator to hear his own sending to any audibility desired.

The foregoing is the electrical story of the new means of "breaking in" with amplified signals. There remains one important mechanical operation to complete the process, namely—the timing of the contacts.

A break-in-key must have at least three sets of contacts. These are, a pair to control the antenna charging source, a pair to shunt the local radiation out of the receiving set and a pair to shunt the telephones. Such a method of breaking in has been found practical, noiseless and positive with greatly amplified signals. It is essential that the telephone shunting condenser contact close first, the receiver contact second and the power contact last and that the contacts open in the reverse order. Breaking in with four stages of audio frequency amplification is practical with this system. It is expected that the Hallborg-Miller key will be available for general commercial use in the near future. Applications for patent are now pending.

The electrical connections of the new break system in an alternating current tube transmitter circuit, with receiver arranged for two stages of audio frequency amplification, are shown in the accompanying diagram. The connections are self explanatory in view of the above description and the notation on the diagram. The accompanying photographs illustrate the mechanical construction of a hand break-in key fitted with adjustable timing screws to perform the functions above outlined. This key is also provided with balanced springs which neutralize the inertia of auxiliary contactors, thereby relieving the operator of unnecessary fatigue in keying.

With the general introduction of the above break-in system, radio traffic may be moved with the facility and certainty of the land wire. The approaching obsolescence of the send to receive switch may now be accepted as an accomplished fact.



Here is the Special Key Equipped With Two Extra Sets of Contacts to Cut the Receiver and Short the Phones While Sending.

Radio Telephone Development in the West

BY HARRY LUBCKE.

THE development of the radiophone and the broadcasting of concerts has been taken up seriously by several firms and amateurs located on the Pacific Coast.

At present there are seven phones working around San Francisco. The first station to come into existence was located at the California Theater and was formerly operated by the DeForest Co. It broadcasted music on a wave-length of 1,250 meters. This station started about a year ago.

About three months after the opening of this station, a set was installed in the Presidio of San Francisco and was operated by the Signal Corps of the Army.

For a while these two stations held a monopoly of the ether, as far as radiophones went.

But their monopoly was rudely broken by the installation of a station at the Fairmont Hotel in San Francisco, operated by the Leo J. Myberg Co., dealers in radio goods. At first this station used only one 50-watt tube and it sure did push the electrons into the air. It was the delight of the "hams" with crystal detectors because it used to come in loud enough to show off to visitors.

(Continued on page 782)

A Study of the Antenna System

By C. M. GRABSON

Part II

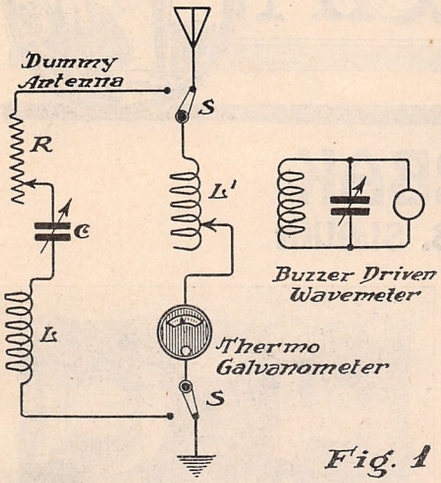


Fig. 1

To Measure the Resistance of an Aerial, the Circuit is First Tuned to the Desired Wave-Length, Then Switched to the Dummy Antenna, Which is Adjusted so as to Have the Same Reading at the H.W.A. The Resistance of R is Then Equal to the Resistance of the Aerial.

MEASUREMENT OF THE ANTENNA CONSTANTS

IN the first part of this discussion of the antenna system, the nature of the different antenna constants was taken up and their bearing on the action and functioning of the antenna considered. This part of the paper will now be concerned with the measurements of these constants.

RESISTANCE MEASUREMENT

The resistance of an antenna can be measured in a number of ways, each method being based upon a different principle. These methods will now be outlined.

1. Artificial Aerial Method: The circuit required in this method is shown in Fig. 1. Switches SS serve to connect in circuit either the antenna proper or the artificial antenna composed of condenser C, inductance L, and variable resistance R. L_1 is a loading coil tuning the antenna to the desired wave-length and this loading coil once it is adjusted is kept fixed in both circuits. In the artificial antenna circuit L represents the antenna inductance, but at high wave-lengths may be omitted without any appreciable effect on the result. C is adjusted to the value of the antenna capacity. A buzzer driven wavemeter W tuned to the antenna wave-length excites the antenna circuit and the deflection on the thermo-galvanometer is noted. The artificial antenna is now connected in circuit and excited by the wavemeter. Any tuning which may be necessary now is accomplished by the condenser C. R is then varied until the galvanometer deflection is the same as before. The resistance thus inserted is, therefore, the same as the antenna resistance. This method is a direct method and the antenna resistance is thus obtained without any preliminary calculations.

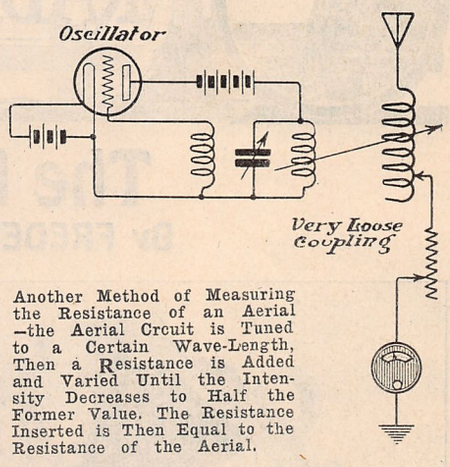
2. Decrement Method: In this method the same circuit is employed as in the first, except that an artificial antenna is unnecessary. The wavemeter is one whose decrement is known. Let this decrement be d_1. Let the antenna decrement be d_2. The wavemeter is tuned to the antenna and excites it and the galvanometer deflection is observed. Let f_1 be the resonant frequency. The wavemeter is now detuned by varying the condenser until the galvanometer deflection is just one-half of the resonant deflection. Let the wavemeter frequency now be f_2 determined from the wavemeter. It is proved in the theory of coupled circuits that the relationship between the decrements and frequencies of these circuits in the above case is given by the formula:

$$d_1 + d_2 = 2\pi \frac{f_1 - f_2}{f_1} \qquad (1)$$

Now d_1 the wavemeter decrement is known, the frequencies are known from the wavemeter, thus the antenna decrement d_2 is calculated. The antenna decrement is given by the formula

$$R = 2\,n\,L\,d_2 \qquad (2)$$

where, L is the antenna inductance, n its natural frequency, and R its resistance. Knowing d_2, L and 2, the resistance of the antenna can be determined. This method, it will be seen, requires the knowledge of the natural wave-length of the antenna, its inductance and decrement, and also requires a considerable amount of calculation.



Another Method of Measuring the Resistance of an Aerial —the Aerial Circuit is Tuned to a Certain Wave-Length, Then a Resistance is Added and Varied Until the Intensity Decreases to Half the Former Value. The Resistance Inserted is Then Equal to the Resistance of the Aerial.

3. In the above circuit, if the wavemeter has a very high decrement compared to the antenna it can be proved that the square of the current in the antenna circuit when excited by this high decrement wavemeter is given by the following:

$$I^2 = \frac{\text{Constant}}{d_1^2\,d_2} \qquad (3)$$

where d_1 is the wavemeter decrement, d_2

(*Continued on page 750*)

Etherless Wireless

By EDWARD THOMAS JONES, I. R. E.

IN the September, 1921, issue of RADIO NEWS, Mr. O. H. Knapp revealed some very interesting, as well as astounding feats performed with ground antennae. As Mr. Knapp states in his last paragraph, "earth conduction will explain many things in radio" and it will not take many more years of time in which to prove absolute earth conduction.

The author has had many thrilling experiences with ground reception (the thrills coming about by results obtained from methods previously scoffed at).

To say offhand, that the earth itself can be used as an antenna would sound more ridiculous, but this is exactly what has been done.

Even the beginner is aware of the results which can be obtained by connecting one side of the telephone leads to earth and holding the remaining one in the hand (permitting the body to act as a capacity). This is one of the feats which, while extremely simple, should cause many of us to stop and think. Refer to Fig. 1 and note that there is nothing but the phones employed in the circuit and the body of the listener is substituted in the drawing by the plate P which forms one side of the condenser with the earth for the other plate of the ordinary condenser. The distance covered by such an arrangement of course is very short, however, and there is nothing to disprove the fact that it can be improved upon.

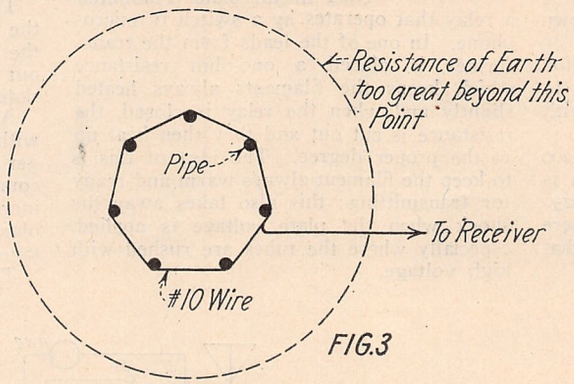


FIG.3

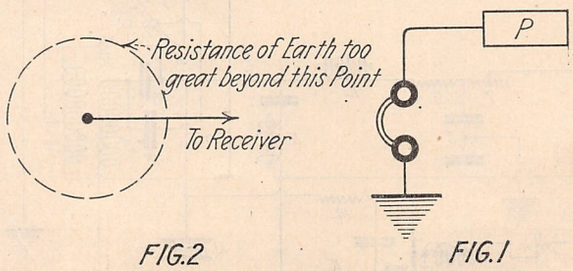


FIG.2 FIG.1

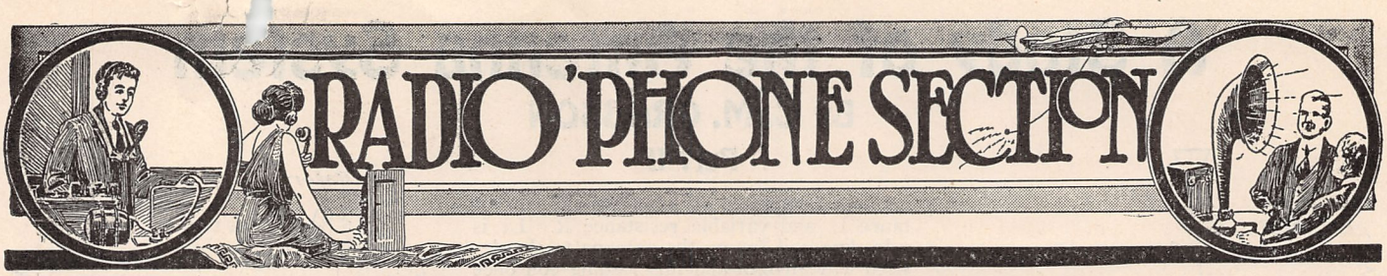
This Diagram Illustrates Some Interesting Experiments Carried Out by the Author on Ground Radio.

With the object in view of improving upon such a system, and eliminate all types of (wire) antennae whether the wire be shaped as loops, coils, etc., the author succeeded in copying messages from vessels at sea several hundred miles distant.

By studying the simple connection to earth I began to get an understanding of the ground antenna's actions. With a small connection to earth it seemed plausible to me that a certain point from the connection to earth, the resistance of the earth itself became so great that it simply eliminated itself from the remainder of the earth insofar as an antenna was concerned.

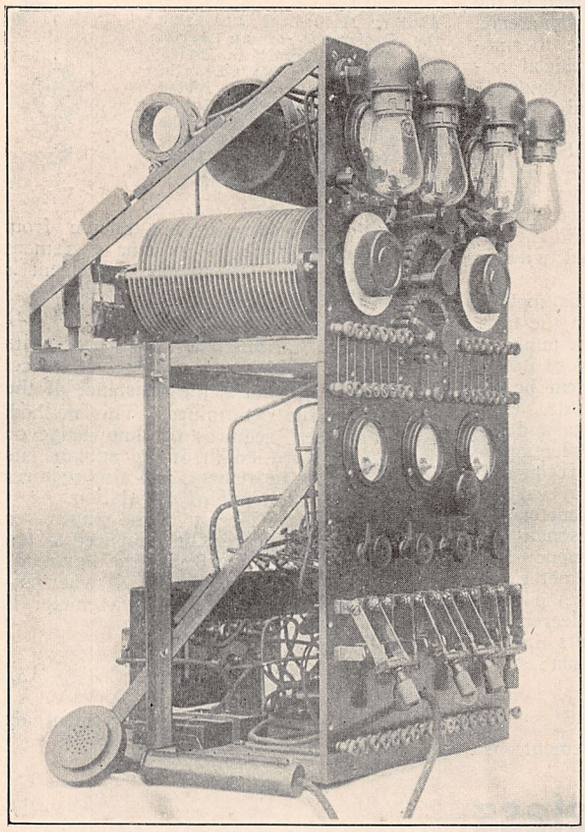
If the reader will confide with me in the drawing shown in Fig. 2, he will begin to understand what I mean. This may be an imaginary theory, however, as it is reasonable to believe that if the earth is acting as an antenna, there must be some por-

(*Continued on page 748*)



The Radiophone at 2BAK

By FREDERICK KOENIG and JOSEPH B. SLAVIN



The Left Side View of the Phone and C.W. Set Designed by Mr. Koenig. Note the Special Condensers With Double Spacing Between the Plates.

THE Circuit in our set is the well known Heising-Colpitts circuit for phone or buzzer, or the Colpitts circuit for C.W. or I.C.W. The circuit is similiar to that used by Mr. J. O. Smith, 2ZI with some modifications.

Using five-watt tubes with 500 volts, 200 M.A. space current .9 ampere radiation is obtained on phone and using 600 volts, 250 M.A. space current on C.W. one ampere radiation is obtained, it will be noted that all the adjustments are variable.

The transmitter is made up in two units and the upper panel contains the transmitter proper, while the controls are mounted on the lower panel.

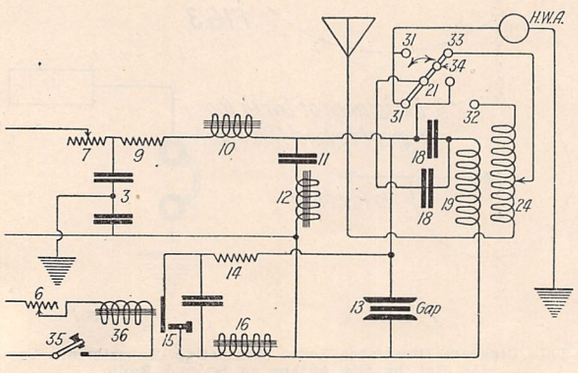
In the upper panel on the right is the grid 0-150 M.A. meter, 0-2½ H.W.A. meter; radio frequency meter is in the center, while the plate 0-300 M.A. meter is on the right. The three-panel type, double-throw switches under the first three tubes are to change from C.W. to phone or vice versa. Switch point under the fourth tube is a variable Ward-Leonard grid leak with taps every 500 ohms.

Three rows of switch points in the center are for the inductance which consists of 34 turns of a hard drawn copper wire wound on a formica tube 4" in diameter and 7" long which has previously been grooved, a tap is taken at every two turns and so on to each switch point common to wave-length, plate and grid coupling switches. Top row wave-length, middle row, plate and bottom row grid coupling.

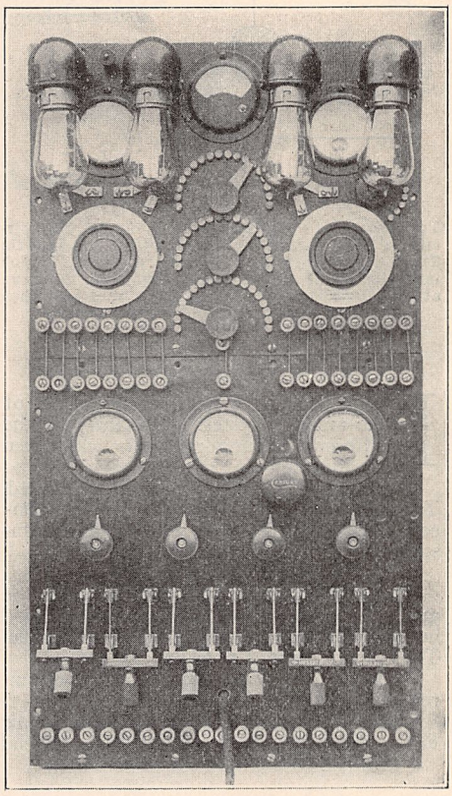
The condenser on the left is a .0015 M.F. feed back condenser and on the right is a .0015 grid condenser. These condensers are made up especially to order and are tested for 1500 volts. An Acme modulation transformer is used with 45 volts on the grid of the modulator tube. In the lower panel are mounted the controls, the meter on the left is an 0-5 A.C. ammeter for the two modulator tubes, while the one on the right is an 0-5 A.C. ammeter for the two oscillators. The one in the center is an 0-15 A.C. voltmeter. A Century buzzer is mounted between the volt and ammeter.

The single throw, double pole switches at the bottom of the panel are as follows: the first one is for C.W., the second for I.C.W., the third for phone, the fourth for buzzer, the fifth A.C. for filament heating and the sixth D.C. for plate. The filament transformer is mounted in the lower panel and is an Acme 10 and 12 volt.

Also in this panel is mounted a relay that operates by a switch in microphone. In one of the leads from the transformer is placed a one-ohm resistance which keeps the filaments always heated slightly and when the relay is closed, the resistance is cut out and they then heat up to the proper degree. The idea of this is to keep the filament always warm and ready for transmitting; this also takes away the shock when the plate voltage is applied, especially where the tubes are rushed with high voltage.



Hook-up of the Arc Set Which is Used at 2BAK in Conjunction With the Tube Set.



Front View of the Power and Control Panels; Two Tubes Are Used as Oscillators and Two as Modulators.

This relay also connects the receiver or the transmitter with the antenna, applies the plate voltage and either lights or puts out the amplifier tubes. It will thus be noted that everything is automatic in this set.

A ground system was at first used, but with the long lead in we were unable to get more than .6 amp. radiation, so a counterpoise system was installed and an increase of .4 of an ampere radiation was obtained. This shows the marked advantage of a counterpoise.

The antenna consists of a five-wire inverted L spaced 2½' and 70' long mounted on iron supports on top of a garage. It is 40' above the counterpoise, which, by the way, is placed under the floor on insulators. It is in the shape of a square and is made in the shape of a spiderweb with the lead in taken from the center.

With this transmitter, long distance transmissions have been accomplished; we may mention among several, the letter of Mr. J. F. Maher, from Mexico, who, on Nov. 18 last, heard our signals QSA. He says in his letter "The night we heard you working 8BA, Detroit, Michigan, your signals were perfectly audible, with that intensity that makes reading a pleasure." This was on straight C.W.

In another letter, from Mr. C. B. Harrison, from Belleville, Ill., we read, "I wish to thank you for the excellent program you sent on New Year's eve; with a three-coil DeForest set and one stage of amplification, the sound was very QSA. Ten sets of head phones in series were used. The chimes at midnight were wonderful and you came in much better than the Westinghouse and Western Electric stations." We were at the time using our phone set and radiating only .8 of an ampere.

THE ARC TRANSMITTER USED AT STATION 2BAK

The arc transmitter which is of the D.C. arc type, with a modifying circuit to break up the sustained waves into audible frequency groups, was shown on page 400 of the November, 1921, RADIO NEWS. For a better understanding of the electrical relation of the various parts of the transmitter, reference may be made to the drawing.

The protective device 3 is for the purpose of protecting the 500-volt generator from high voltage surges, which may occur in the transmitting apparatus. It consists of two mica condensers in series across the line, the middle point being connected to the ground.

Nos. 6 and 7 are respectively the exciter and the radio generator field rheostats; 9 is the line resistance; 10 is a line inductance; 11 is the tone circuit condenser; 12 the tone circuit coil, and 13 is the spark gap, which consists of two tungsten gaps in series. No. 14 is the igniting circuit resistance; 15 the contacts of the relay key; 16 is the igniting circuit inductance; 17 a small mica condenser around the relay key contacts; 35 is the hand-key, and 36 the relay key magnet. The hand-key and relay key operate on the 110-volt circuit of the exciter.

The primary oscillating circuit consists of the condensers 18, the air core inductance 19, and contacts 21 on the wave-change switch. The secondary oscillating circuit comprises the antenna, the inductance 24, the hot wire ammeter, and the ground connection.

PRINCIPLE OF TRANSMITTER OPERATION

For a clear understanding of the operation of this type of transmitter, we may divide the complete apparatus into six separate circuits as follows:

(A) The hand key circuit comprising the 110-volt supply, the relay key magnet 36, the hand key 35.

(B) The direct current transmitter circuit comprising the generator, the line resistance 9, the line inductance 10, and the spark gap 13.

(C) The igniting circuit comprising the resistance 14, the relay key contacts 15, the igniting coil 16 and the condenser 17, together with the gap 13.

(D) The tone circuit comprising the condenser 11, the inductance coil 12, and the gap 13.

(E) The primary high frequency oscillating circuit comprising the condensers 18, the contactors 21 of the switch, and the primary of the magnetic coupler 19.

(F) The secondary high frequency oscillating circuit comprising the antenna, the secondary of the magnetic coupler 24, the thermo ammeter and the ground.

We will start by assuming that the hand key is up and, therefore, the magnet 36 is not energized, and the contacts 15 of the relay key are closed. The current then flows from the generator through the resistance 9, the inductance 10, through the igniting circuit, and thence back to the generator.

The hand key is now depressed, and the contacts 15 are open. Due to the fact that the current flowing in the inductance coil 16 of this igniting circuit, has now been suddenly interrupted by opening these contacts, a voltage higher than the line voltage is thus generated, and breaks down the gap 13. At the same time the tone circuit condenser 11 has received a charge, partly from the line voltage, and partly from the voltage generated by the igniting circuit, and it now discharges across the gap.

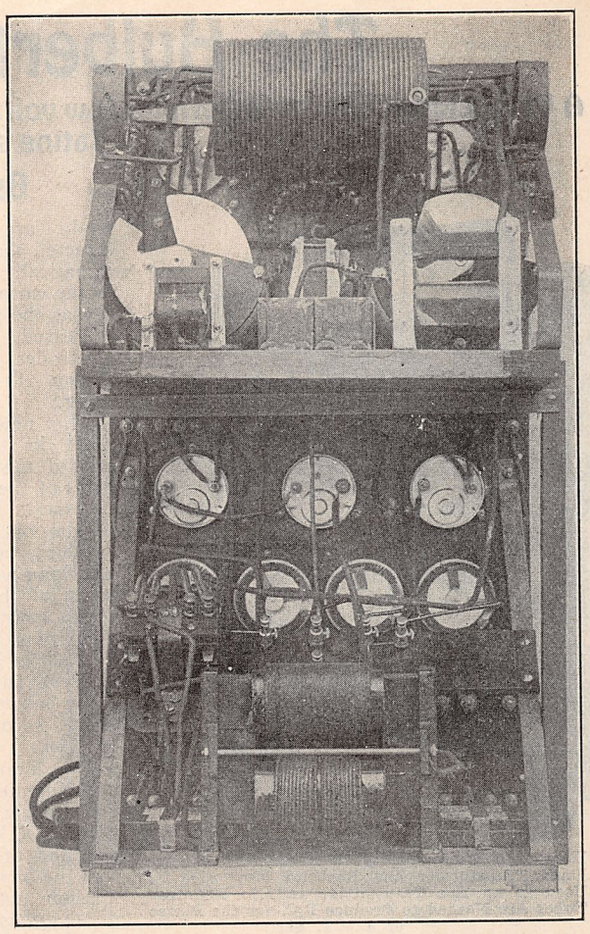
In so discharging it carries with it some current from the direct current line, since the direction of charge of the condenser, and the polarity of the line are in this case the same. The condenser having completely discharged and become charged in the opposite direction, its attempt to discharge again across the gap is opposed by the new opposite polarity of the line voltage. The gap, therefore, goes out, and will remain out until the condenser 11 is again completely charged in the original direction. The gap is thus periodically ignited and quenched by the tone circuits 11 and 12, the time period of this ignition being roughly determined by the value of capacity 11 and inductance 12.

During the time that the gap is ignited, it acts as an oscillating direct current arc, and high frequency oscillations are passing across it, the period of which oscillations is determined by the capacity 18 and the inductance 19. These oscillations, due to the magnetic coupling 19 and 24, set up radio oscillations in the antenna circuit which oscillations are radiated in the usual manner.

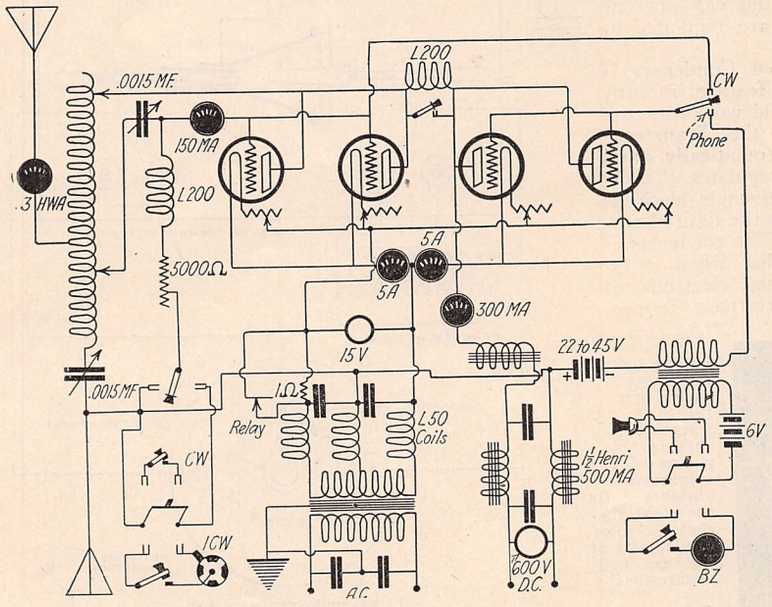
Two wave-lengths are provided of 300 and 600 meters, and the primary is tuned to these wave-lengths by the condensers 18. The capacity of .03 MF is connected permanently in the primary oscillating circuit, and the second capacity of .09 is connected in all the contacts 21 when the wave-change switch is thrown to the 600-meter position. The contacts 32 and 33 on the wave-change switch are connected to adjustable points on the secondary inductance for tuning to the wave-lengths provided, and either one of these points may be selected by throwing the connecting bar 34 to the position desired, the contacts 31 being connected together and through the thermo ammeter to the ground.

A send-receive switch is also mounted on the transmitter panel by means of which either the transmitter or the receiver may be connected to the antenna. This switch is constructed exactly like the wave-change switch, the auxiliary contacts in

(*Continued on page 766*)



Back View of the Radiophone Showing the Filament Heating Transformer, Relay and Parts of the Power Unit.

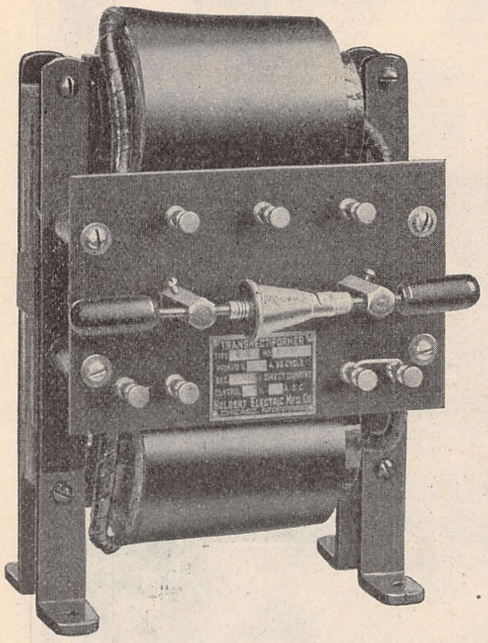


Complete diagram of connections of the radiophone and C.W. set built by the owner of 2BAK.

The Hulbert Transrectiformer

A Unique device for transforming low voltage A.C. and rectifying it to high potential D.C. and oscillating same in one apparatus

By L. H. HIND



Here is a Real Novelty in Radio. This Combined Transformer and Rectifier May Also be Used as an Arc Transmitter and No Kenotron Tubes Are Needed to Produce D.C. for the Plates of a V.T. Set.

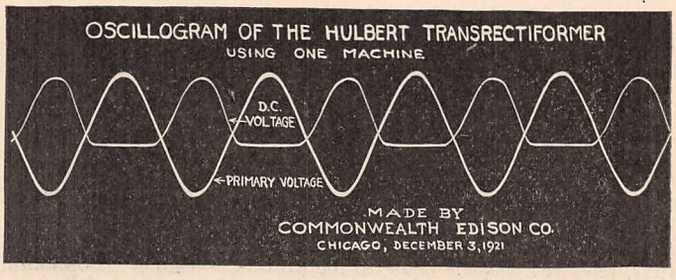
THE Transrectiformer is an apparatus which, by a new and original method, at one operation transforms and rectifies low voltage alternating current to high potential direct current and oscillates same if desired. It is designed for 300 watts, 110 V., 60 cy., 3. A., A.C. to 3000 V. to 10,000 V., 30 M.A., D.C. It utilizes a closed core transformer consisting of three branches, on which are mounted the coils used in stepping up the voltage and rectifying.

The Transrectiformer relies upon an arc of a special type, which is housed within a metal cone and operates in the open air.

In the earlier model of the Transrectiformer described in the October issue of RADIO NEWS, a spark gap consisting of three zinc electrodes was used; the third electrode being interposed between the two active electrodes and acting as a balance point.

Since then, the inventor, Clinton H. Hulbert, of Chicago, carried on exhaustive tests with numerous types of electrodes, until the present type of an arc was evolved. This arc consists of a heavy platinum wire electrode on the one side, and a specially constructed bronze electrode on the opposite side. The platinum electrode is housed within a specially designed cone, which itself acts as a balance point of the arc, and replaces the former center zinc electrode. This cone and the bronze electrode are so constructed that they automatically conform to the variation of the arc as the potential is increased, and when electrodes are withdrawn from each other.

This new improvement in the arc is one of the main features of the Transrectiformer. It operates in the open air and produces a transparent flame very similar to an alcohol or hydrogen flame and possesses many of the characteristics in operation of a vacuum tube. The arc requires very little adjustment, is controlled by the Hulbert balanced condenser and is especially adapted for Radio telegraphy, and highly recommended for key C.W. transmission.



If But One Transrectiformer is Used, Only One-half of the Oscillations is Rectified, as May be Noted in This Curve.

The Transrectiformer provides for the experimenter a unit of 300-watt capacity well within his means for the very latest type of C.W. transmission. To commercial and other high power stations, it offers the benefits of a system of C.W. transmission entirely free from many of the disadvantages of the present system. No vacuum tubes are necessary. The electrodes are set so as to operate from 10 to 40 M.A., D.C. without any adjustment, and the D.C. voltage is simply controlled by varying the load on the rheostat.

The use of one Transrectiformer affords numerous methods in transmitting. The apparatus can be adjusted so as to give direct current and then oscillate this current when transmitting, by inserting a key, with a grid leakage from the cone to the ground. This gives strong oscillations and a clear sharp tone is produced. Another simple way is to adjust the Hulbert condenser so as to produce continuous oscillating current and transmit by key to vary the sending impedence. The various degrees of tone from the arc are regulated by the condenser.

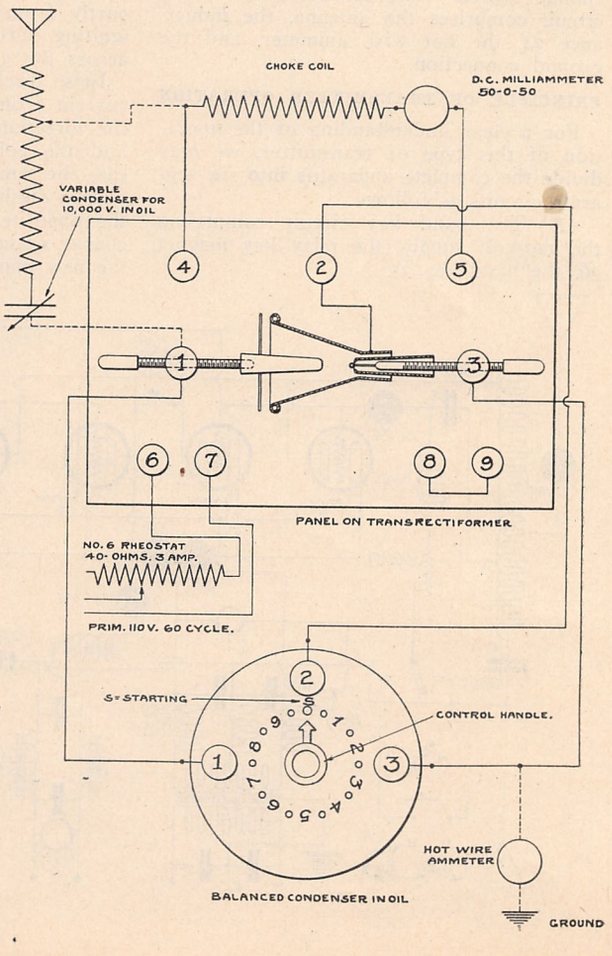
The Balanced Condenser is another new feature recently brought out and works in conjunction with the Transrectiformer. It automatically starts the arc and regulates the degree of sensitiveness desired; it also controls the desired current wanted. The condenser is so designed that when it favors the bronze electrode of the Transrectiformer, it produces a direct current, and when it favors the platinum electrode an oscillating current is produced.

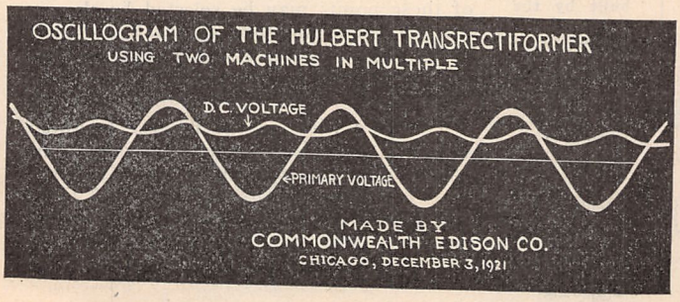
The oscillograms show the wave of one Transrectiformer by which one-half of the sine is rectified, and of two machines in multiple, by which both sides of the sine are rectified.

The Hulbert Transrectiformer gives to the scientific world the answer to a need that has been long felt, namely, a simple inexpensive and reliable method for producing high tension direct current. Experimenters and scientists have realized for years that much of the future of electrical and scientific progress lay in the realm of high potential direct current, but to produce this current has usually been too expensive for the average experimenter and often unreliable.

The future for transmission of high po

(*Continued on page 762*)





On the left, the curve shows how full A.C. rectification is obtained by means of two transrectiformers. On the right the sketch shows the details of the arc and connections.

Radio Digest

ARGENTINE HIGH-POWER STATION.

A new powerful German wireless station has been constructed at Monte Grande, in the Province of Buenos Aires, and was successfully tested. Messages were received from stations 15,000 kilometers distant. In the course of the tests a code message being transmitted from San Francisco to Tokio was picked up.

The station has been installed over an area of 1,400 acres. When completed, it will consist of six big towers, each of which is to be 630 feet. It is asserted that the station will be able to communicate with points all over the world. Service is to be started about the middle of next year for receiving, and in February, 1923, for sending.

RADIO FOR PARIS POLICE.

A wireless telephone is to be the newest scientific acquisition of the Paris police department.

Keeping abreast of the times, M. Leullier, the Prefect of Police, has requested a budget of 60,000 francs for the purpose of installing an experimental system with a view to enlarging it in time to cover the entire department. The first apparatus will be installed on three automobiles, one being that of the Prefect, thus permitting him to keep in touch with headquarters wherever he is called. The other two cars will be used for such emergencies as riots and wrecks, for patrol duty where disorder is anticipated and for police officials guarding important ceremonies. The apparatus on all the cars will have a sufficient radius to cover the entire Seine district.

WITTENBERG COLLEGE TO INSTALL RADIOPHONE.

Installation of a "special license" radio telephone set is now contemplated by the authorities of Wittenberg College, Springfield, Ohio, with the probability that a course in wireless telegraphy and telephony will be added to the curriculum of the educational institution. The college recently installed a small phone set as a test, and the faculty and board was so pleased with the result, that plans for installation of better equipment are being arranged.

According to the college officials, regular programs will be given during the college year for the benefit of radio operators in this district. Co-operation with Ohio State University in broadcasting state market and weather reports is also planned. Ohio State began this transmission about January 1, according to arrangements. There had been considerable discussion of an Ohio college radio press service. Practically every college in the State has wireless equipment of sufficient range to reach any other Ohio college and organization is all that is required. If the Ohio college radio press service is established, co-operation with the press in the various cities is contemplated. The newspapers would furnish outside news reports for transmission by radio, while the colleges in turn would furnish the press with such news matter as is received by radio from other points in the State.

ABSENT ROTARIANS ADDRESSED BY WIRELESS.

Rotarians assembled recently in more than 50 towns, within a radius of 100 miles of Pittsburgh, to listen to the speeches of the Rotary Club International Vice-President, Ralph Cummings, and District Governor, Roy Neville, who addressed Pittsburgh rotarians in McCreery's dining room. They received the addresses by the aid of the wireless telephone, to broadcast the speeches through radio station KDKA. In addition, many other people were able to hear the speeches of these prominent Rotarians. This was the first time in history that a meeting of this nature was received by other branches of the organization at different points, without the members attending the gathering in person.

WESTINGHOUSE CO. TO COVER COUNTRY WITH RADIO BROADCASTING SERVICE.

On account of the great success and wide-spread interest that has been the outcome of pioneering in radio telephone broadcasting by the Westinghouse Electric & Manufacturing Company, the company has announced a complete plan of covering the entire United States with a service to the home that will allow anyone, anywhere in the country to enjoy the many benefits of radio. The operation of the first radio broadcasting station of its kind in the country at East Pittsburgh, Pennsylvania, for the past twelve months, has opened possibilities hitherto undreamed. From this station alone persons in Canada, New England, Florida, Arizona, the Dakotas, and at greater distances have been able to enjoy the service. Even in Cuba, Mexico and on ships in the Middle Atlantic and on the Gulf of Mexico many have heard the concerts broadcasted from East Pittsburgh.

In order to cover certain parts of the country not reached by this station, and to intensively serve other parts, the Westinghouse Company has laid out a complete program, and has already added three large stations. At Springfield, Mass., station WBZ supplies New England; at Newark, N. J., station WJZ takes care of the Middle Atlantic and Southern States; and at Chicago, Ill., station KYW serves the Middle and Western States.

The fact that the pioneer work of Westinghouse has not been in vain is shown by the fact that although operating a full year, station KDKA at East Pittsburgh continues to interest more people as time progresses. This is due, however, not so much to the novelty of radio telephone broadcasting, as to the well-planned and diversified program that has been established. The service started with the transmission of Presidential Election returns in November, 1920, and has progressed through the broadcasting of phonograph music, entire church services, speeches of prominent men, acts from theatres, musical recitals, reports of boxing contests, results of baseball, football and basketball games, complete minstrel shows, Government market reports, New York stock market reviews, national and international news from the station at East Pittsburgh. At Springfield, Mass., in addition to many of these features, there is a periodical talk to farmers about market and stock conditions. A feature of the Newark, N. J., broadcasting station has been bedtime stories for the children, Marine information, and talks on radio. The complete transmission of grand opera from the Chicago Opera Company productions has been the feature of the recently established station on the Commonwealth-Edison Building in Chicago. It is predicted that as a result of the diversified entertainment and information which have been broadcasted through these stations during the past year, this service will prove of expanding value and distinctive interest to mankind. In all probability radio will be as popular in the home as the phonograph is today, and will be of as great interest to the public as the moving picture show.

In order to perfect the transmission of music by radio, Westinghouse engineers have made considerable research studies of the different frequencies of music. A studio has been built especially for the singing of artists so that the reproduction will be accurate. The studio at East Pittsburgh consists of a room 20′ by 30′ completely lined with burlap and cloth and without windows so that there will be no reflection of sound. A chart is used to determine the proper position of the microphone and a report is made for each musical selection. These reports are checked later with the reception qualities at a receiving outfit. A considerable amount of data already obtained indicates the proper methods of transmitting various types of music.

This work is simply a sample of the many things being done to perfect the service and make radio broadcasting a real benefit to the public.

Radio Articles Appearing in the February Issue of Science and Invention

- Collapsible Antenna for Submarine Radio.
- Radio in Arctic Exploring.
- Announcement of $300.00 in Prizes to be paid for the best and cheapest radiophone set.
- Receiving Radiophone Concerts—With diagrams showing the very latest powerful amplifying circuits with audions, as well as the simplest hook-up possible for a cheap home-made set to receive "the jazz from the air."
- Building a Pocket Radio Set—Suitable for receiving radiophone concerts as well as radio-telegraph stations.
- "Talking" Over a Trolley Wire—A combination of wire and wireless communication.

RADIOPHONE POPULARIZED IN FRANCE.

Every French manufacturer can now have a private wireless telephone system connecting his factories with the central office in Paris, thanks to the decision of the French Ministry to commercialize the recent wireless successes.

Whether this will be followed by general permission to install wireless telegraph apparatus on tops of Paris buildings on the payment of a substantial fee remains doubtful. It is evident, however, that the Government will not let anything stand in the way of obtaining new revenues, and as there is no longer any need for French censorship of either incoming or outgoing messages it is suggested that the time is not far distant when Paris correspondents will have direct communication with their newspapers across the Atlantic, each with a special salling signal and wave-length assigned to him by the French Government.

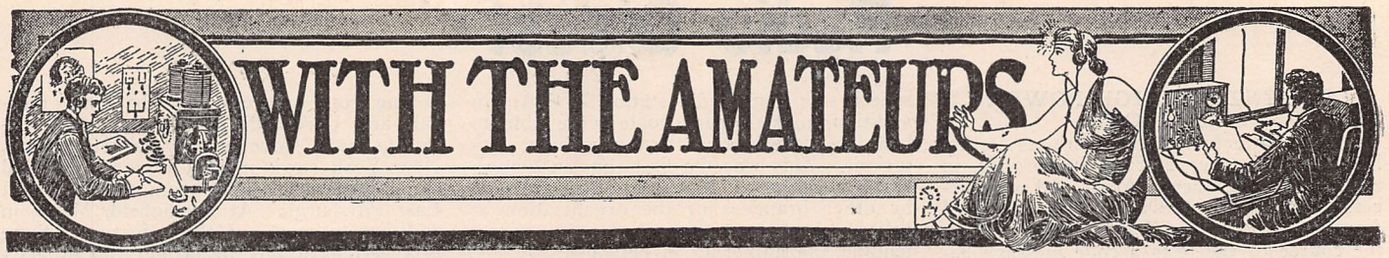
AWARDS OF AMRAD NAME CONTEST.

Monroe Cox (1CJR), Swampscott, Mass., is the first prize winner of the Amrad Variometer Name Contest which was announced in these columns and ended December 31st.

Amrad "Basketball" Variometer is the name selected by the Committee of Award, and it will be used hereafter in the company's advertising.

Raymond R. Howe, West Lafayette, Ind., with "Minimax," and Wendell J. Reed (1BYL), of Auburndale, Mass., with "Xe-lent," were awarded second and third

(*Continued on page 782*)



THIS Department is open to all readers. It matters not whether subscribers or not. All photos are judged for best arrangement and efficiency of the apparatus, neatness of connections and general appearance. In order to increase the interest in this department, we make it a rule not to publish photographs of stations unaccompanied by a picture of the owner.

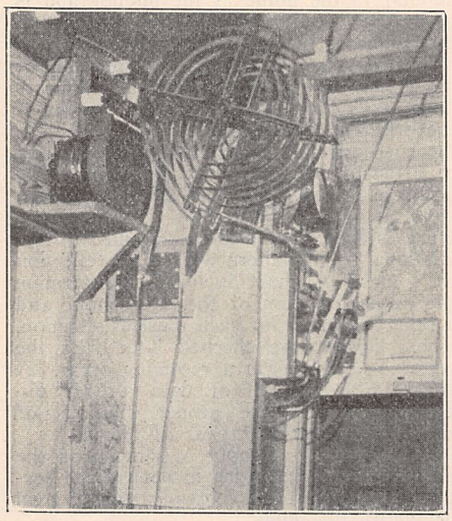
We prefer dark photos to light ones. The prize winning pictures must be on prints not smaller than 5 x 7". We cannot reproduce pictures smaller than 3½ x 3½". All pictures must bear name and address written in ink on the back. A letter of not less than 100 words giving full description of the station, aerial equipment, etc., must accompany the pictures.

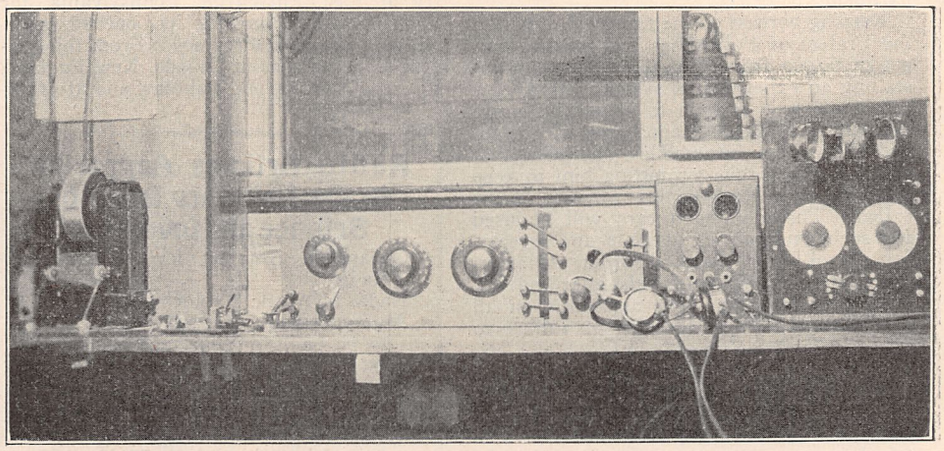
PRIZES: One first monthly prize of $5.00 All other pictures published will be paid for at the rate of $2.00.

Winford Brown's Station, 4BI

at Miami, Fla.

This Month's Prize Winner





Win. Had the Good Idea to Install the High Tension Circuit of the Transmitter so That Nobody Can Touch it and Get Shocked. Besides the Well Designed Transmitter, He Has a Very Complete Receiver, Including a Long-Wave Tuner and Short-Wave Regenerative Set.

I AM enclosing a picture of my set which you may put in RADIO NEWS if you see fit. I am using a Grebe CR-2 receiver and a Grebe RORH detector unit, combined with a Radio Shop two-step amplifier. I have a honeycomb set for the long waves. I use Baldwin and Brandes phones. All the wiring on the receiver is under the table, except a few bus bar connections from CR-2 to detector unit.

On the sending side I have a ½-K.W. Thordarson transformer, a Dubelier mica condenser .004 capacity, Chapp-Eastham rotary gap, Thordarson O.T. transformer, Jewel ammeter and a Murdock antenna switch. My radiation is about 2¾ amperes. My aerial is composed of six 7-strand copper wires, and is 55′ long. At the north end it is 60′ high and at the other 46′ high.

My ground is a piece of copper 3′ x 6′, buried in water. I also have a fan-shaped ground arrangement.

WINFORD BROWN, 4BI.

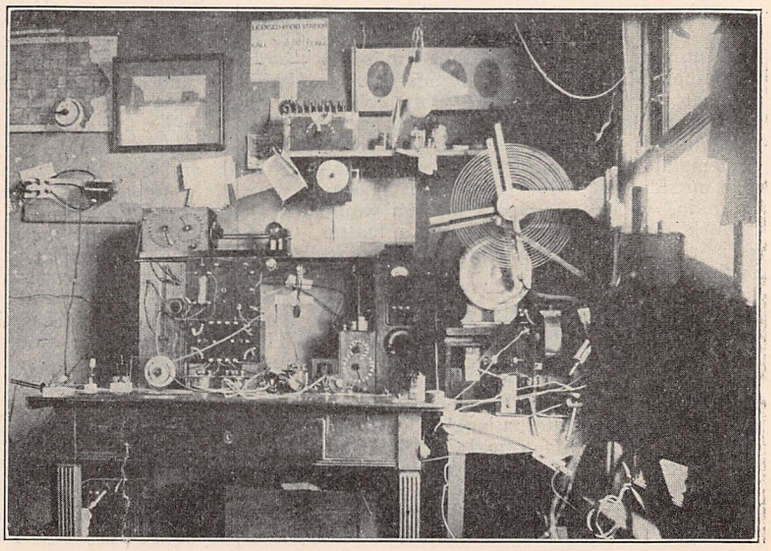
Chauncy Hoover's Station, 9AMU

at Marshalltown, Iowa

I SEND you herewith picture of my station which I hope you can make use of in RADIO NEWS. The following is a description.

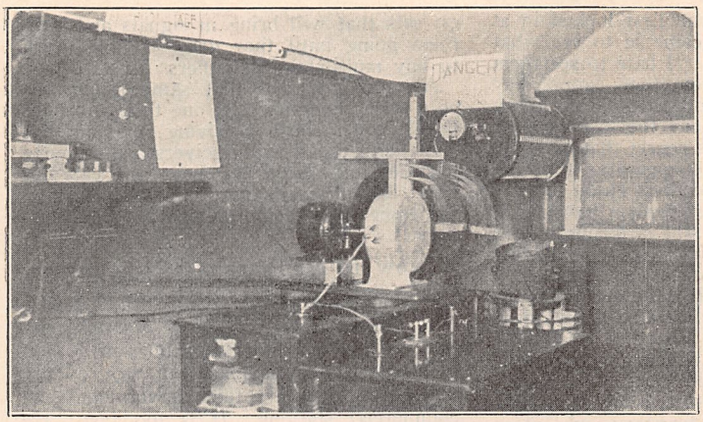
The antenna is composed of five wires, 60′ long and 45′ high. The ground consists of a counter-poise and earth ground. The transmitting set consists of a half K.W. Thordarson transformer, Benwood gap, oil condenser and large O.T. The receiving set consists of a long-wave tuner, seen at the upper left-hand corner of the picture. Directly below, is a short-wave regenerator and detector panel of my own design. To the left is the plug and jack system for controlling the receiving set. On the right is a small coupler of special design used in connection with the short-wave receiver. Four variables and phones complete the receiving set. A short-range radiophone completes the equipment. The transmitter has been heard 1,000 miles. The receiving equipment is very efficient, as amateurs from almost all the districts have been heard.

A home made station which has some good records. Those fellows up there in Iowa are lucky not to have the Q.R.M. which we have around here.

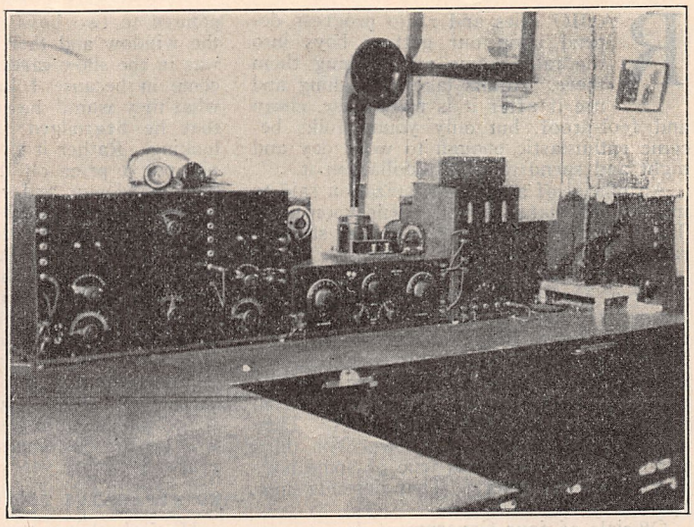


M. L. Potter, Jr.'s Station, 9ABL

at Kankakee, Ill.



You Still Find Them on the Job, These Old-fashioned Leyden Jars. Potter Uses a Bunch of Them and Finds Them Satisfactory.



Remember This Receiver? It Was Described in Last Month's Radio News. Here We See it On the Job.

THIS is a photograph and description of my radio station, 9ABL. It is located at Kankakee, Ill., fifty miles south of Chicago, and has been in operation about six months. During this time all of the Districts, except the sixth and seventh, have been worked.

The receiving set consists of a detector and two-stage amplifier and Universal tuner (which was described in detail in the January issue of RADIO NEWS) for spark and undamped waves up to 20,000 meters, a Grebe short-wave receiver and Baldwin phones. By means of two key switches, the amplifier can be thrown from one receiver to the other in a few moment's time.

The transmitter consists of a United Wireless 1-K.W. open core transformer, 12 Marconi Leyden jars (series parallel; total capacity is .006 mfd.), Benwood rotary Quenched Gap, (eight studs), driven by a 1/5 H.P. induction motor at approximately 5,000 r.p.m., Marconi hinge type O.T. and homemade pancake O.T. (the latter of which is in use now), and a Jewel Ammeter.

Two aerials are used, one for long-wave reception and the other for short-wave transmission and reception. The former is a one-wire triangle, 150′ on a side and 50′ high, and the latter comprises a six-wire inverted L, 75′ long and 40′ high.

Practically all the high powered stations of the world have been copied with ease.

Perhaps it will be well to say that the long-wave tuner and amplifier were designed and made by D. R. Clemons, instructor at Dodge's Institute of Telegraphy, Valparaiso, Ind.

I am now building a C.W. set, using three V.T.IIs and hope I will be able to give some of the stations in this vicinity some radio jazz in the near future.

M. L. POTTER, JR.

Kankakee, Ill.

Harold E. Sturm's Station, 9DGG

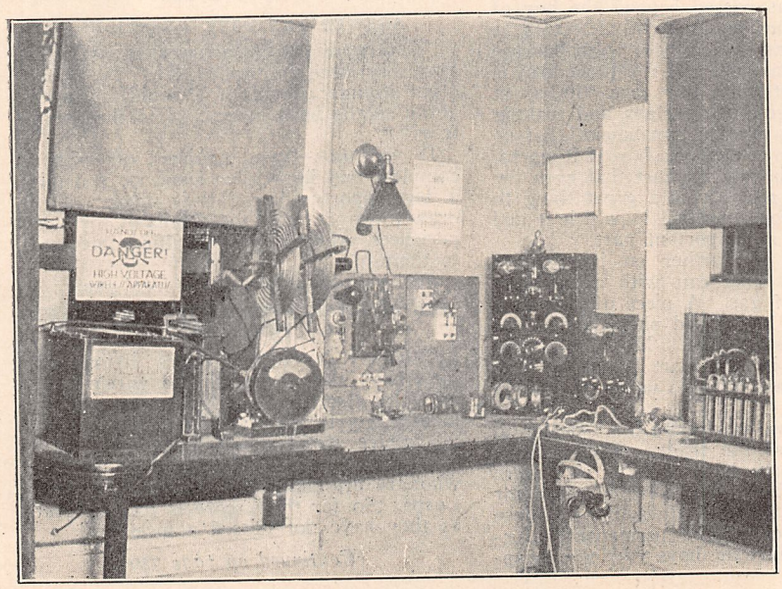
at Macomb, Ill.

I AM sending you a picture of my station (9DGG). At the left of the picture is seen my transmitting set, which consists of a 1-K.W. Thordarson transformer, plate glass condenser, rotary spark discharger, and oscillation transformer. I made my receiving cabinet, which is a one-step amp. using V.T. tubes and honeycomb coils. Next to that is seen a small radiophone set for use around town. To the extreme right is seen my "B" batteries, which are storage cells made from test tubes. I have three of these batteries, two containing 20 cells each, and one 24 cells, which combined produce 130 volts for plate voltage. For charging I have a home-made motor generator set, which charges both "A" and "B" batteries. My antenna is the flat top "T" type, containing four wires, 90 feet in length and 35 feet high. The ground connection is made of four copper ribbons taken from old Ford magnetos, buried directly under aerial. I also use the gas main and the tin roof, which is under one end of the aerial.

I get much pleasure and very good results from my set, many times hearing five or six radiophones at one time, can hear amateurs plainly in the 9th, 8th, 6th and 5th Districts, some of them loud enough to hear five feet from the phones.

HAROLD E. STURM (9DGG).

Macomb, Illinois.



A nice, complete station you have O. M., and compliments for the "B" battery. We know it works fine, we have one here.

A Magnetic Amplifier

BY WILLIAM H. DORIVAL

WHILE experimenting with a V.T. detector, I have found that by placing a large horse-shoe magnet directly in front of the bulb so that the north pole of the magnet is just below the plate, a large amount of amplification may be had, especially on waves of 1,500 to 4,000 meters.

The magnet should be placed on a block of wood or other material, in such a way that the distance between the pole and the bulb may be varied at will. The magnet ia also valuable for varying the pitch and the tuning in of C.W. stations.

I have actually tuned N.P.G. spark in so loudly as to make him readable a distance of 12′ from the phones and N.A.A. could be read at a distance of 20′ from the phones, while without using the magnet, they were just readable with the phones on.

Perhaps the position of the magnet will vary with the different makes of detector tubes; the writer used an old type Audiotron.

Keeping the Boys at Work

By ARMSTRONG PERRY

RADIO sales and radio progress depend upon our getting boys into the radio game and keeping them there. Adults take up a thing and use it after it is made easy, cheap and fool-proof, but only young folks become enthusiastic enough to work day and night and spend their last dollar on it.

An official of a radio organization said to me: "I find that I cannot depend upon boys. They are too young. They do not stick to radio."

The first part of his statement I do not question, for it is based on his own experience. He knows. The second part is not true. I have been working with Boy Scouts since the Scout Movement started in America in 1910. My job for fourteen years before that was interesting boys in useful activities in the Y. M. C. A. They are not "too young." I know. The third part of the statement is true of some boys and untrue of others. That depends upon leadership.

Officials of four Government departments in Washington have expressed to me a desire for the Scouts to serve as local receivers and distributors of information transmitted from Washington by radio. The Army offers them free instruction in theory and code. These officials have before them the records made by the Boy Scouts in service for the War Department, the Navy Department, the Treasury Department, the Agricultural Department, the Committee on Public Information and other Government departments and bureaus during the war. They do not think that the boys are too young. What chance for local dealers to render patriotic service by directing the Scouts in their radio activities and at the same time lay a permanent foundation for bigger business.

Whenever a man says "I cannot get boys to stick to a job," or "I cannot get people to pay their bills," or "I cannot induce voters to vote right," look at him and you will see the main reason. He is it. I do not mean this as an adverse criticism of the man. He may not be a "boys' man." He may be efficient in other ways. But if he tries to do any one of these three things and does not succeed, the reason is in himself. Other men do succeed. It is due partly to personality, but there are principles which have led to success even when followed by men who in the beginning had everything to learn.

In the general problem of promoting radio, the only new element is radio. The other elements are exactly the same that have been stated, diagramed and analyzed in all the salesmanship courses. The securing of attention; the development of interest; the arousing of desire; the production of action—every salesman knows them all. But in selling radio to boys, the prospects themselves take the first three steps with the same alacrity that they vault a fence to get at a full apple tree. Attention, interest and desire are there just as soon as you show a boy a radio set in operation. Action follows if the dealer makes it possible.

A dealer talking to me across the counter pointed to two boys who first looked in at the window and then came in to see what was in the show cases. "I hate to see them come in because I know they cannot buy what they want," he said. He did not mean that he begrudged them the pleasure of looking. Rather it was regret that he could not put a price on the apparatus that the boys could pay, and see them enjoy it.

This man is typical of dealers today. He has been highly successful in business. He keeps abreast of the times, showing all the newest and best apparatus as soon as it comes out. He has built a radiophone transmitter that is a marvel and he maintains a broadcast schedule so that his customers may receive music for dancing and interesting news items. But he does not consider as part of his field these two boys—and the 20,000 like them in his territory—who alone will be his customers, if he has any, ten years or twenty years from now.

NO APPARATUS TOO CRUDE IF IT WORKS

He feels that generally speaking the radio game today has passed beyond the boy of fifteen. He considers mineral detectors as relics of the past. He stocks them because there is an occasional call for them, that is all. He forgets that boys are still, as in all the past ages, using clubs and making stone axes and wooden tomahawks, that no apparatus is too crude for a boy, if it works. He does not play up the fact that even the simplest radio receiver is a great thing to have nor develop a system in which it and boys can play an important part.

A boy will go farther on imagination alone than his Dad can with a twin six and a barrel of gas. A piece of galena, a cat whisker, a low-priced phone and a coil of wire will start him. Most boys will start that way if they start at all, and few persons will start in radio unless they start young.

It is not a waste of time for a dealer to develop the juvenile trade. The twin-six dealer would have hard sledding if it were not for the fellows who develop trade for him by selling flivvers. In radio, I believe the same dealer, to be permanently successful, must start the boys with the cheapest sets that will bring in signals and keep them going until they grow up and begin to buy multi-stage amplifiers.

Assume now that that same dealer has been wise enough to sell one thousand boys in his town cheap receiving sets and has made sure that these receivers are properly installed and that every boy can hear signals. The problem now is to keep them at the game and develop them into paying customers.

HOW TO GET PERSONAL INTEREST

The first thing is to make sure that they pick up something of direct and personal interest every day. A boy will not understand at first much, if any, of the traffic that he hears from government and commercial stations. It is too fast. He will get tired of listening to that in a few days. But if the dealer has told the boy that at half past eight every night he is going to get *dah d'dah d'dah* from him and a message that he can understand, it will take a Tom Mix picture or some other powerful attraction to pull him out from under his head band.

You can tell him, at five words per minute, or by radiophone if you have power enough to penetrate a mineral detector, that you are organizing the thousand beginners of the town into a Radio Emergency Corps, or whatever you want to call it. It needs to be an impressive title. Every boy who picks up the test message every evening for one week will be eligible for membership. The young operator must copy the messages on a piece of paper, sign his name and address and mail his copy to you.

Now don't get excited about having to read one thousand scrawled communications. Somebody else is going to do the heavy work.

By the time two or three messages have gone out you will be visited by a few boys who will ask questions like this:

ANSWER THE BOYS' QUESTIONS

"Why were the signals weaker last night than they were the first night?" "Wouldn't I get stronger signals if I would fasten my aerial to the barn instead of to the cherry tree?"

If you turn these inquirers off without complete and impressive answers, you miss a big opportunity. Satisfy them. Then draw them out. Get the details of their experiences, which are of thrilling interest—to them.

Write a paragraph for the local paper:

"JUNIOR RADIO OPERATORS' REMARKABLE PROGRESS

"Thomas Jones and James Henry, two local boys who never heard a wireless signal until they purchased amateur outfits a month ago, began standing watch Monday to receive the test messages broadcasted at 8:30 P. M. daily by Smith & Proctor, who are organizing the Radio Emergency Corps. So far their score is 100 per cent., as they have not missed a message."

(Continued on page 730)

IN this article Mr. Armstrong Perry touches on a subject that is of vital importance to the radio art, and should be read by everyone interested.

Why is it that the average amateur, when once he has gained a fair knowledge of radio becomes a bad snob, and treats disdainfully every novice who enters the radio field? We cannot all use five-stage amplifiers, and we are apt to forget that in our younger days it was great fun to play with a silicon detector, and a 75-ohm receiver.

There is a tremendous market for the manufacturer and dealer in instruments for the novice. This market, to-day seems to go to seed, chiefly on account of intolerance. The radio man who snubs the novice may be compared to the man who, after having climbed to the top of a mountain looks back disdainfully at the man below who is just beginning to climb and is not only unwilling to lend a hand to the man below, but actually throws stones in his path.

Therefore, you who know, lend a hand to the radio novice, whether he is a boy in knickers, or one of the boys with gray beards just starting in, in the game.

Remember always that when you bought your first camera, nine times out of ten it was a cheap contraption. So it was with the first phonograph, and when you bought the first 25c safety razor. Do not discourage the man who wishes to try a Galena detector, a tuner and a pair of phones. He is the greatest asset to the radio community, and should be helped and instructed the same as you were helped and instructed when you stood at his level.

—Editor.

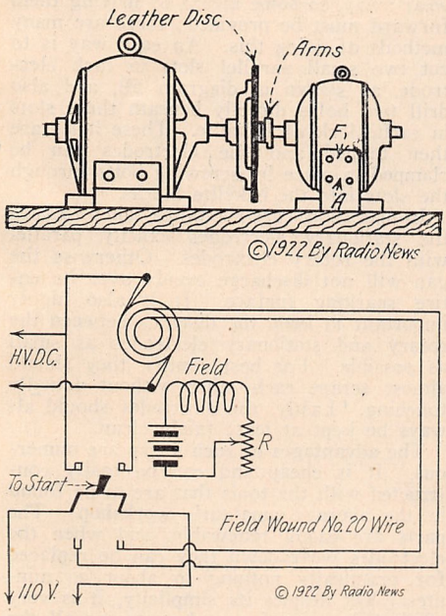
High Voltage for the V. T.

By EVERETT LEO DEETER

THE average layman of a radio outfit, especially the telephone, is continually confronted with that demand of a high voltage current for the plate of the V.T. More than once have amateurs failed, or given up, on account of having no means to supply the necessary plate voltage.

Where only 22.5 to 40 volts are needed, it is a very simple matter to connect up a few batteries of the flashlight type for this current, but a battery to supply a voltage of even 200 would cost in excess of $13, and is not practical for anything but short distance work with one or two tubes.

The rectifiers find an opening here. There are various types, and where an alternating current is available, it may be stepped up and rectified to furnish the high voltage direct current. Two common methods make use of the electrolytic and the tube rectifying action. The latter is the better



A Rewound Motor Makes a Good Generator for a Small Set. It May be Driven by Another Motor, as Shown Here.

of the two, but either will function well if properly handled. Fig. 1 illustrates how these methods operate.

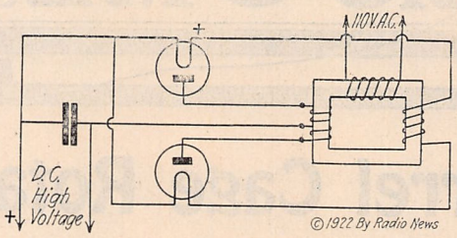
Mechanical rectifiers very seldom answer the purpose for plate or filament purposes, as the best designed vibrators leave a gap in between cycles, breaking them off before they reach the zero line. This is shown in the curve in Fig. 2.

The ideal way of deriving the high voltage is, of course, by the use of a motor generator set.

The fondest hopes of many amateurs are often brought down to earth when he "pops the question"—to Dad. "Seventy-five dollars for a motor generator set! Not on your life, son."

He must then either raise the money himself or go without, for it is impossible to convince uncle, aunt, grandfather, brother-in-law or school-ma'am sister of the importance of that "dreamland of high voltage." (But notice how they all gather in to hear the first telephone speech, bugs!)

After many days of hard labor he gathers in the cash and hurries to the radio palace (supply house) to get his heart's desire.



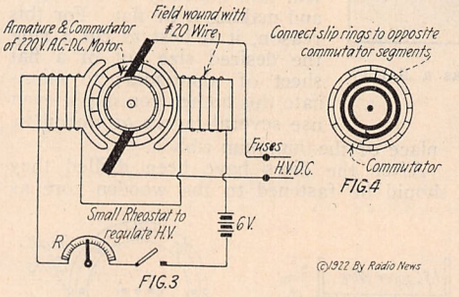
Hook-up of Kenotron Rectifiers to Transform A.C. Into High Tension D.C.

Is that the way you purchased your sets, bugs?

Well, I never, No SIR!

Let me tell you how I got mine, at hardly any cost at all, with all my ready cash left to spend on my girl and V.T.'s. (Really now, that's all that counts, isn't it?)

I dropped in at the electric company's office and seated myself. There was no one in but Mr. Electric Fan and he was going. Anyway he went with me, for the boss came in and, after a period of dramatic and oratorical speaking, I succeeded in trading a good gold watch for the little 8" fan I wanted and went merrily on my way.



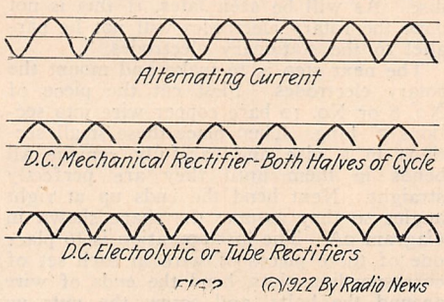
Constructional Details of a Rebuilt Motor to be Used as a Generator.

The watch was a good one, not only stopping when it had run down, but about six times that often. Anyway, what did I care for the watch?

When I got the high voltage for my 12-stage amplifier, it would be easy to pick up time signals that had died out months ago.

It was a shame to tear the fan up, and especially with the coming of hot summer days. I could imagine the heat wrapped panels, added static condensers, the solder melting from my aerial connections under the heat, etc. But, after deciding, I would rather be floating around the room on overrun mercury from the thermometers than go without the general set, I proceeded.

Removing the field winding of the motor, which was a 220-V. D.C. or A.C. type, with



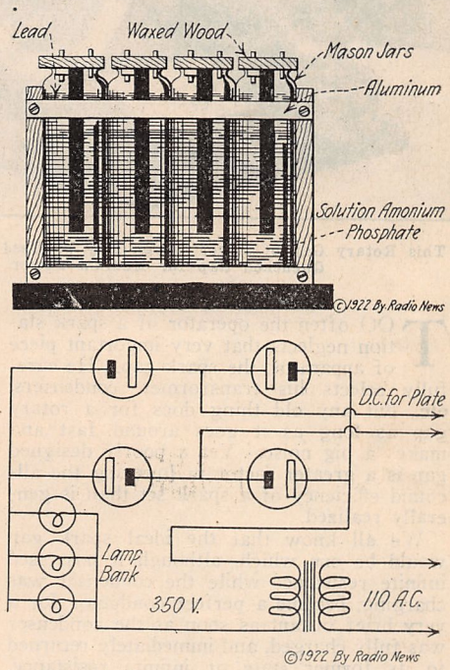
Various Forms of D.C. Obtained From Rectified A.C. as May be Seen the Kenotron or Electrolytic Rectifiers Are the Most Efficient.

a six-segment commutator, I placed on a winding of No. 22 D.C.C. magnet wire, using all the turns possible on each pole without hindering the turning of the armature. Connecting, as in Fig. 3, I had the desired high voltage generator. It was mounted with an A.C. motor on a base of hard wood or slate, and was ready for use.

The power motor may be a low voltage type where necessary and may be operated from storage batteries, making it also suitable for portable sets. Its size will depend upon the size of the generator it turns.

By increasing the current through the field of the generator, any voltage up to 600 may be had, but with the small fan motors it is not advisable to use a voltage higher than 350, as the armature winding is liable to break down. The larger fan motors are better insulated and will stand higher voltages in the armature.

As the current delivered is quite small,



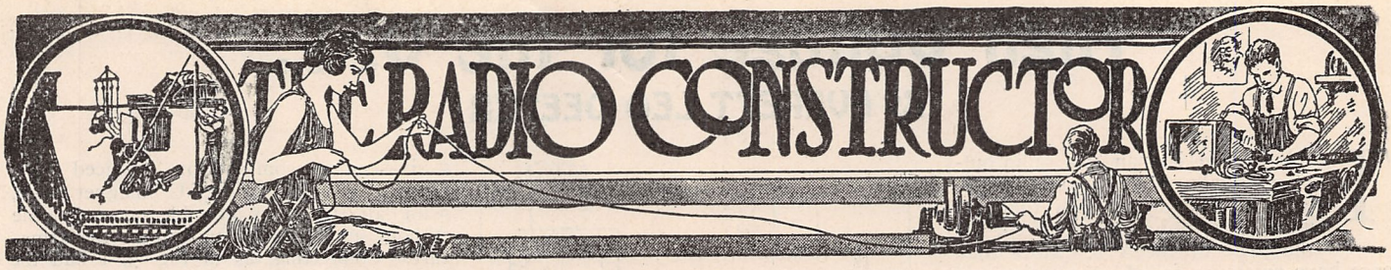
An Electrolytic Rectifier May Also be Used to Supply the High Voltage D.C. to a C.W. or a Radiophone Set. Above is Shown the Rectifier Itself and Below the Diagram of Connections for Same.

the armature should be protected with a very small fuse wire. The usual filter system is used in connection with this set.

For those wishing from 40 to 130 volts for amplification purposes, or short distance C.W. or radiophone work, the writer has designed a simple and efficient method by use of a small rotary converter made from a small A.C. or D.C. fan motor, such as mentioned before.

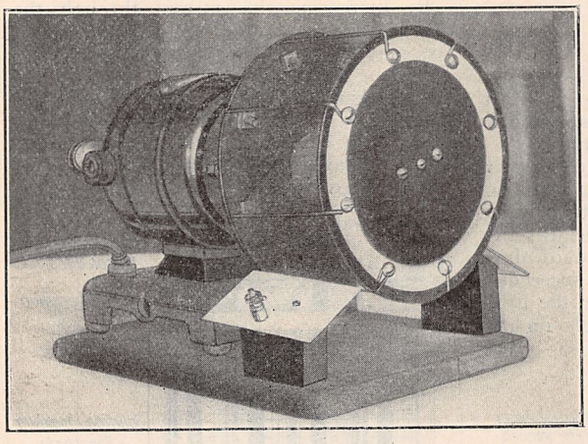
Fig. 4 shows the connections of the synchronous converter. When the switch is thrown to the right, the motor is connected as usual when used as a fan motor, and after picking up speed it is connected as a synchronous motor through the slip rings added to the armature, by throwing the switch to the left. Direct current can be taken from the commutator. If the fan is operated from 110 A.C. the D.A. delivered will be about 130 volts. The reason for this is that in such converters the ratio between the A.C. and D.C. is always 1 to 7.

(*Continued on page 791*)



A Squirrel Cage Rotary Gap

By FRED A. BURGESS



This Rotary Gap of Novel Design May be Used as a Rotary Quenched Gap for Medium Power.

TOO often the operator of a spark station neglects that very important piece of apparatus, the spark gap. He carefully selects his transformer, condensers, etc., but any old thing does for a rotary gap as long as it goes around fast and makes a big noise. Yet a poorly designed gap is a greater factor in lowering the all-round efficiency of a spark set than is generally realized.

We all know that the ideal spark gap would be one which, although it possessed infinite resistance while the condenser was charging, became a perfect conductor for a very brief instant as soon as the condenser was fully charged, and immediately returned to its former state of infinite resistance. Unfortunately, such conditions can not be obtained in actual practice. It is true, a well built rotary gap fulfills them almost as well as any other style of gap, but still leaves much to be desired. In this article we shall attempt to describe a rotary gap which, although perhaps no better than the gaps on the market to-day, is of unique design, can be quite easily built, and is very efficient in operation.

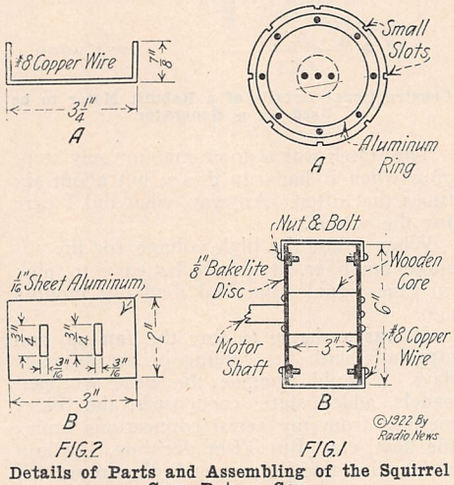
As can be seen from the photograph, this gap is equipped with broad, knife-edged electrodes, since experience has proven that they cool more quickly and give a better quenching effect than any other type. In addition to this the rotor is quite light in comparison with the cumbersome and weighty rotors on most of the gaps now on the market. This is quite an advantage, since it considerably increases the speed of the motor.

Diagrams 1A and 1B show the constructional details of the rotor. The materials consist of two discs of bakelite 6" in diameter and ⅛" thick; a piece of thin aluminum ribbon about 20" long and ½" wide; a round piece of wood 3" long and 1½" in diameter; 16 round headed brass bolts; and 4' of No. 8 or No. 10 solid bare copper wire.

Diagram 1A is a side view of one of the discs. Around the periphery of each disc, eight equally spaced slots are cut in the bakelite. These slots should be ⅛" wide and ⅛" deep. Exactly in line with each slot, and about ¾" from the edge of the bakelite, a hole is drilled to accommodate a bolt for holding the electrodes in place.

The aluminum ribbon is used to connect all the electrodes together. It must be placed on the outside of one of the discs, as shown in diagram 1A, and eight holes punched in it to correspond with the bolt holes. If you use straight ribbon you will find difficulty in curving it and making it lie flat. For this reason, it is best to cut a ring the desired size out of a flat sheet of aluminum; to eliminate this bother you might even use several layers of tinfoil in place of thealuminum ribbon.

After the discs have been drilled they should be fastened to the wooden core as shown in diagram 1B. In doing this, you must be very careful to get the slots of one disc exactly opposite the slots of the other disc. As will be seen later, if this is not done the rotary electrodes will not lie parallel to the stationary electrodes.



Details of Parts and Assembling of the Squirrel Cage Rotary Gap.

The next step is to make and mount the rotary electrodes. First cut the piece of No. 8 or No. 10 bare copper wire into sections 5" long. Then place these small sections in a vise and carefully remove all bends in them until they are perfectly straight. Next bend the ends up at right angles so they assume the shape shown in diagram 2A. The last operation is to place one of these pieces of wire in each set of corresponding slots, bend the ends of wire around the bolts, and screw the nuts up tightly. The positions that the wires will now occupy is shown at the top and bottom of diagram 1B.

The stationary electrodes, one of which is shown in diagram 2B, consist of pieces of sheet aluminum 3" long, 2" wide, and ⅛" thick. They are mounted on small blocks of bakelite in such a manner that when a rotary electrode is exactly opposite one of them, another rotary electrode is exactly opposite the other one.

Of course these electrodes will gradually wear away, so some means of moving them forward must be provided; there are many methods of doing this. An easy way is to cut two small parallel slots in each electrode, as shown in diagram 2B, and also drill two holes directly beneath these slots in each block of bakelite. These holes are then tapped and the electrodes can be clamped in place by screwing bolts through the slots into the bakelite blocks.

In operation, care should be taken to keep the stationary electrodes exactly parallel with the rotary electrodes. Otherwise the gap will not discharge evenly over its entire sparking surface. It is also highly important to keep the distance between the rotary and stationary electrodes as small as possible. For best results, they should almost scrape each other without actually touching. Lastly, the electrodes should always be kept at least fairly clean.

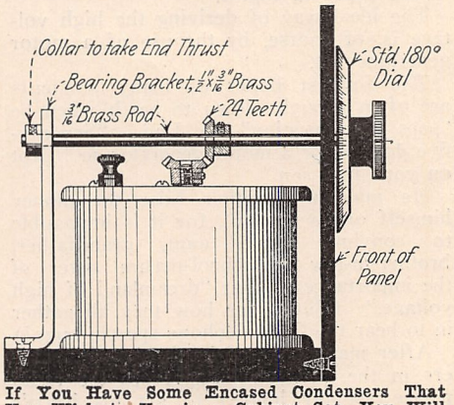
The advantages of such a gap are numerous. It is cheap and can be easily constructed with the tools that are to be found in the average amateur's workshop. The parts are easily renewable, and when the electrodes wear down they can be replaced for practically nothing in about 20 minutes. Yet despite its simplicity, it is very efficient in operation and possesses all the good features of the best rotary gaps.

Gear Your Variable

MANY amateurs are discarding their old variables and purchasing the panel tye condenser with the counter-weight.

When the 23-plate condenser is used in this scheme, with the 2 to 1 ratio gears, as fine a vernier adjustment is obtained as any amateur will ever want.

Contributed by E. H. CUMMINGS.



If You Have Some Encased Condensers That You Wish to Use in a Cabinet Set, You Will Find This Method of Mounting Convenient.

High Tension DC from AC with a Mechanical Rectifier

By C. J. PADDON

THE following was designed to take the place of the unreliable and expensive rectifier tube and the fuming electrolytic rectifier.

It consists primarily of a strip of bakelite mounted on a vibrator which is excited by a magnet wound for 110 volts A.C. At the extremities of this strip are placed double contact points, which are connected to B.P.s by flexible H.T. cable. Opposite these contact points are mounted binding posts which have threaded into the brass rods each carrying a knob at one end and a contact point at the other. Connections are made from these to B.P.s as per Fig. 1.

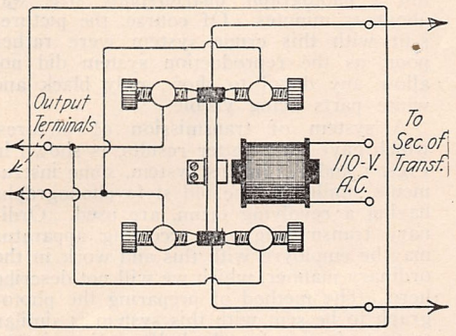


FIG. 1

Top View of the Mechanical Rectifier Which May be Used to Supply the Plate Voltage to a C.W. Set.

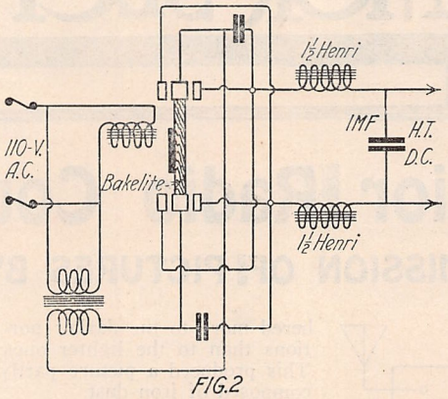


FIG. 2

Complete Hook-up of the Rectifier With Step-up Transformer and Choke Coils.

Now let us consider the operation of this apparatus. It will be noted that if a vibrating steel reed is placed near the core of an electromagnet which is charged with alternating current, it will be repulsed and attracted directly as the charge of the magnet varies in polarity.

Now let us consider Fig. 3. When the primary of the transformer is + charged, the vibrator is attracted by the magnet, which is shunted across the primary; this brings the moving contact against the set of fixed contacts A and A¹, thus conducting the secondary current straight to the output terminals C and C¹. When the primary is — charged, the vibrator is repulsed, effecting the secondary circuit through B and B¹. In this case, as the charge is reversed, the contacts are connected to the *inverse* output terminals so that the output charge retains the same polarity.

It will be wise to place condensers across the contacts to prevent sparking and to straighten out the hum with choke coils. This will work well up to 750 volts and give a constant, steady supply of current. Fig. 2 shows complete hook-up with the transformer condensers and choke coils.

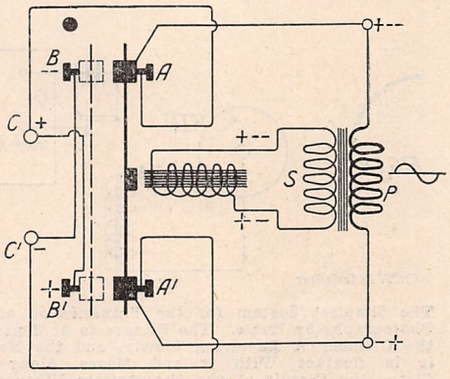


FIG. 3

This Diagram Shows the Extreme Positions of the Vibrating Armature and the Connections of the Transformer to the D.C. Binding Posts.

Conserving the Phones

By C. CHANDLEE PIDGEON

EACH time you turn on your receiving tube filaments or turn them off, each time you change your phones from detector to one or two stages of amplification with the filaments lighted, you send a surge of flux through the phone magnets, due to inductance of their windings. A slight surge of flux occurs each time the phones are affected by an incoming signal. During the time when filaments are lighted and the "B" batteries are connected, there is a constant magnetic field set up in the windings of the phone magnets.

If the flow of current is in proper direction through the windings of the phone magnets, it will tend to reinforce the permanent magnets. If, however, the flow of current is in the wrong direction, it will oppose the permanent magnets and in time will weaken them, making the phones less sensitive than when new. It is, therefore, advisable to connect the phones in the circuit so that the current in the windings strengthens the permanent magnets and helps to keep the phones as sensitive as when new.

Here is a simple method for determining the polarity of the permanent magnets and for making the proper connections to cause the current in the windings to reinforce them.

If a small pocket compass is at hand, it may be used. If not, a compass needle may be made as follows: Take a small cylinder of cardboard or paper (wrap a few turns of paper around a pencil) and wind 20 or 30 turns of annunciator wire or No. 20 S.C.C. wire around it. The solenoid thus made may be two or three inches long. Connect this solenoid to a 6-volt storage battery with a switch and a resistance of about 5 ohms in series (see Fig. 1). Place an ordinary sewing needle about 1½" or 2" long, in the solenoid and close the key or switch for a few seconds. This needle, when suspended from a fine silk thread (push the needle through a knot in the end of the thread), will point north and south, thus indicating its polarity.

If the compass needle be now suspended over the magnets of a phone receiver, with the diaphragm and cap removed, it will assume such a position that the north seeking (known as the N. end) will be over the South pole of the receiver magnet. After having in this manner found the polarity of the permanent magnets, mark them in some manner and proceed with a study of the windings. Carefully remove the paper covering, if any, from one of the tiny coils. Note the direction in which the wire is around the core, being careful not to disturb or break it. Make a diagram similar to Figs. 2 and 3, showing the direction of winding, and indicate by arrows the direction of the current flow to give the same polarity as the permanent magnets.

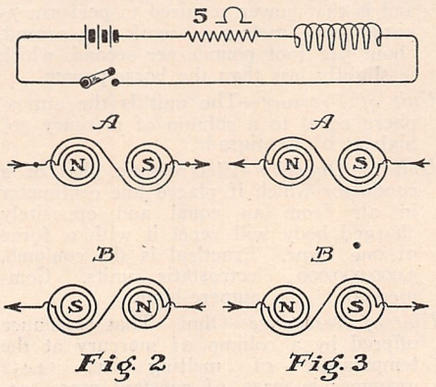


Fig. 2 Fig. 3

When a Pair of Phones is Connected Directly in the Plate Circuit of a V.T., the Magnets May Lose Their Magnetism if Connected in the Wrong Way. In This Article is Explained How to Find the Proper Pole to be Connected to the "B" Battery.

Figs. 2 and 3 are diagrams to show the proper direction of current through the windings represented to produce the polarity indicated, looking at the magnets with the cap and diaphragm removed.

Having determined the correct direction of current flow, connect the receiver cords to secure it. Mark one cord tip with a distinctive marking by putting some colored silk about it or dipping it in ink. If you use plugs and jacks, it will be necessary to see that the jacks are properly wired. In making connections it is necessary to remember that the flow of current in the phone circuit is *from* the binding post (or jack spring) nearest the filament connection *through* the phones *to* the binding post (or jack spring) nearest the plate of the vacuum tube, irrespective of the exact location of the "B" battery relative to either of two points.

Wireless Telegraphy in Japan

BY GEORGE J. TEED AND ROBERT W. YOUNG.

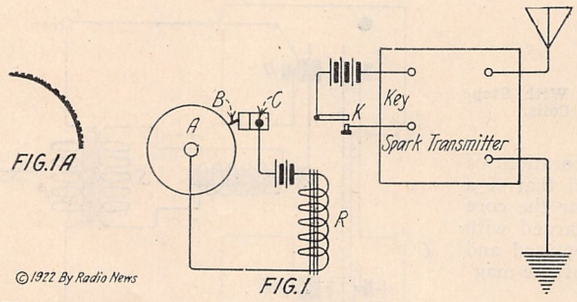
THE year 1917 marked the "coming of age" of wireless telegraphy, that is, twenty-one years had elapsed since Signore Marconi applied to the British Government for his first British Patent, in 1896. Experiments were then carried out in which Radio communication was established over a distance of one and three-quarter miles.

The first experiments with wireless in Japan were carried out in 1896 under the

(*Continued on page 781*)

Junior Radio Course

TRANSMISSION OF PICTURES BY RADIO



The Simplest System for the Transmission of Pictures and Photographs by Radio. The Picture to be Sent is Fixed Upon the Cylinder A Revolving Slowly, and the Needle B Which is in Contact With it and Moves Along the Cylinder Closes the Circuit of the Transmitter Whenever it Touches the Spots in Relief of the Picture.

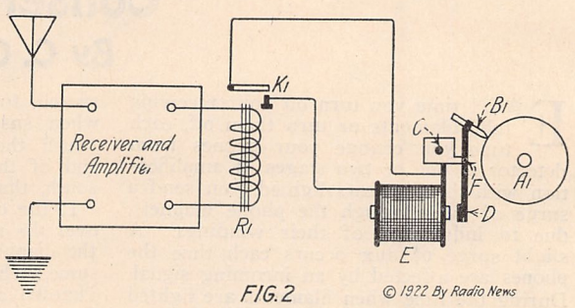
THE first practicable attempt to transmit pictures by wireless was made in 1908 by Mr. Hans Knudsen, although at the time there was no efficient system to send pictures by wire. The Knudsen transmitter consisted of a flat table to which a horizontal to-and-fro motion was given by a clock-work motor. Upon this table was fixed a photographic plate which had been prepared in the following manner: The plate upon which the photograph to be transmitted was taken, was coated with a gelatine film three or four times thicker than that of ordinary photographic plates and in the camera was placed a single-line screen which broke the pictures into lines. Upon the plate being developed, and before it was completely dry, some very fine iron dust was sprinkled. Since in this type of plate the transparent parts dried much quicker than the darker ones, the iron dust sprinkled over the plates adhered more to the darker portions than to the lighter ones. This produced a picture partly composed of iron dust.

A steel point attached to a flat spring rested upon this plate and was made to travel at right angles with the motion of the table. As the picture was composed of iron dust and the steel needle was fastened to a delicate spring, both the needle and the spring were set in a state of vibration. This vibrating spring made and broke the circuit of a battery connected in a primary circuit of a spark coil hooked up to an aerial and ground in the usual manner. The receiver consisted of a similar table to that used for transmitting, and carried a glass plate that had been smoked on one side; a similar spring and needle were placed over this plate, but were actuated by means of a small electromagnet in circuit with a battery and a coherer. As the coherer made and broke the battery circuit by means of the intermittent waves sent out by the transmitting aerial, the needle was made to vibrate upon the smoked glass plate in synchronism with the needle of the transmitting set. Scratches were made upon the smoked plate and these reproduced the picture of the original plate.

A print could be taken from the scratched plate in a similar manner to an ordinary photograhic negative. The time taken to transmit a photograph, quarter-plate size, was about 15 minutes. Of course, the pictures sent with this crude system were rather poor, as the reproduction system did not allow any detail to show, only black and white parts being visible.

A system of transmission of pictures, which gave little better results, is shown in Figs. 1 and 2. In this system, some instruments similar to the old style phonographs having a revolving drum, are used. Ordinary transmitting and receiving apparatus may be employed with this and work in the ordinary manner, which we will not describe here. The method of preparing the photograph to be sent with this system is similar to that of preparing the halftone for picture reproduction in newspapers and magazines. The picture is first photographed through a screen producing on the positive a series of dots which are more or less far apart. This

(*Continued on page 780*)



At the Receiving End the Same Apparatus is Used But a White Sheet is Fixed on the Cylinder; Each Time the Receiver is Operated the Pen B1 Marks a Dot on the Paper Reproducing the Picture Sent by a Multitude of Small Dots.

Dictionary of Technical Terms Used in Radio

Unit of Inductance—Henry. Is that inductance in a circuit when amperage is changing at rate of one ampere per second, and producing a D.P. in that circuit of one volt.

Unit of Magentic Flux—Weber. Is produced by a current of one ampere flowing through a circuit with one henry or inductance.

Unit of Momentum—F.P.S. one pound with velocity of one foot per second. C.G.S. one gramme with velocity of one centimeter.

Unit of Potential—Volt. Pressure which, steadily applied to a conductor, having a resistance of one ohm, produces a current of one ampere.

Unit of Power—F.P.S. Power required to perform one foot-pound of work per second. For commercial purposes a larger unit is used, namely the horsepower, which is power required to perform 550-foot poundals per second. C.G.S. Unit is power required to perform one Erg of work per second. Electrical, is watt which is power which will perform one Joule of work per second. Commercially the kilowatt is used equal to one thousand watts. French is Force-de-Cheval, and is that power required to perform 75 kilogramme meters of work per second, about 542 foot pounds per second, which is slightly less than the horse-power.

Unit of Pressure—The unit is the atmosphere equal to a column of mercury 30" high at 0° Centigrade.

Unit of Quantity—Electrostatic, that of a conductor which if placed one centimeter in air from an equal and oppositely charged body will repel it with a force of one Dyne. Practical is the coulomb, 3,000,000,000 electrostatic units. Commercial is the ampere-hour.

Unit of Resistance—Ohm. That resistance offered by a column of mercury at the temperature of melting ice, 14.452 grammes in mass, of constant cross section and having a length of 106.3 cms. That resistance which permits a current of one ampere to flow when a pressure of one Volt is applied.

Unit of Torque—Pound-foot and is that Torque which is exerted by a force of one pound at a radius of one foot. Compare Foot-Pound.

Unit of Velocity—F.P.S. One foot per second. C.G.S. One centimeter per second.

Unit of Work—F.P.S. Foot-poundal, and is work done by one poundal moving its point of application by one foot. C.G.S. Erg, and is that work done by one Dyne moving its point of application by one centimeter. 421,390 Ergs equal one foot poundal. Practical calculations are generally based on the Gravitational Units, namely, F.P.S. Foot-pound is that work done by raising one pound one foot perpendicularly. C.G.S. gramme centimeter and is that work done in raising one gramme one centimeter vertically. Electrical Unit is the Joule. which equals ten million Ergs.

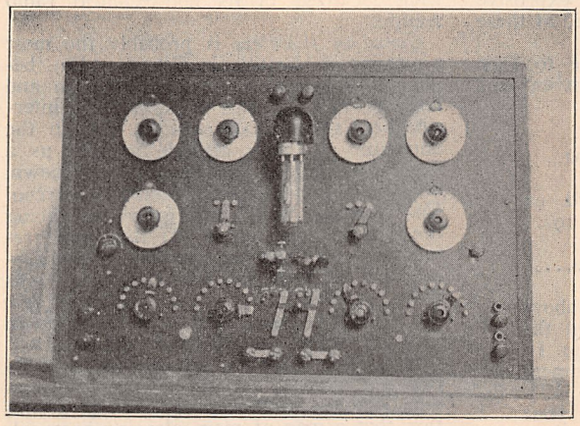
Unlike Charges—See Law of Magnetism.

Vacuum Tube—A glass tube exhausted of air and having two electrodes, one at each end, used for the production of various rays, such as the Cathode Rays, Rontgen

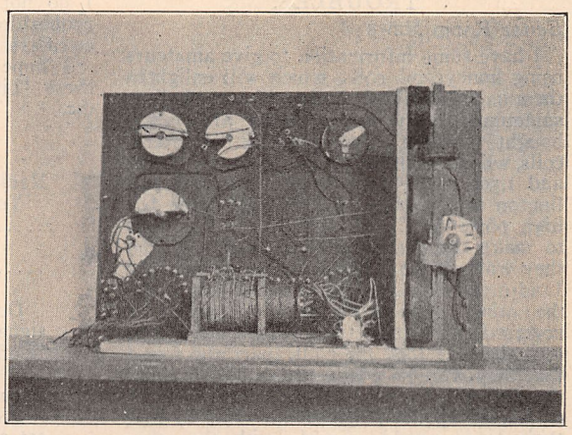
(*Continued on page 787*)

A Combination Universal Receiver

By K. MATSUMOTO



This Combination Receiver for Long and Short Waves Has a Crystal and a V.T. Detector Incorporated in it. Either of These May be Used.



Inside View of the Receiver Showing the Coupler, Loading Coils and Condensers.

A COMBINATION receiver of loose coupler and single coils using crystal or audion detector may be easily constructed by any amateur.

Doubtless all radio stations without audion detectors are not considered modern, yet a crystal detector meets the necessity of listening in to the stations within its reach, and cuts down the cost of upkeep of the amateur stations where only batteries are used as the source of current supply.

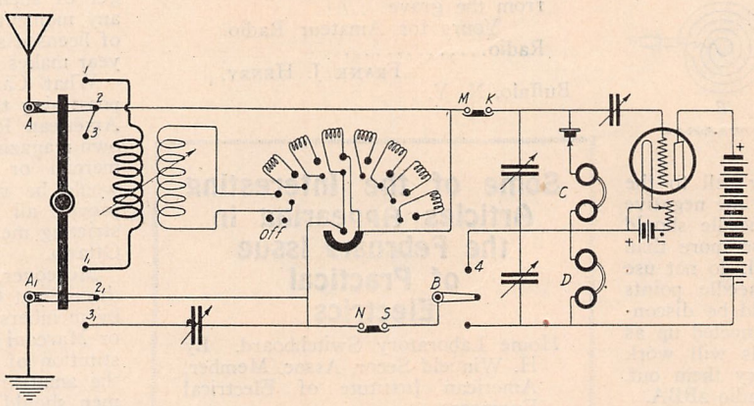
This descriptive article, accompanied by a diagram and photographs, deals with my home made receiver for both damped and undamped signals, using either crystal or audion detectors. This receiver ranges from 150 to 25,000 meters, with short and long-wave tuners, detectors and their necessary controls all mounted on one panel.

The loose coupler is a home made bank-wound type ranging from 150 to 3000 meters. The single coils are home made stagger-wound and home-wound coils of G.R. type. Each coil is independent of the other, and is tightly fastened to a coil stand at right angles to the other.

The operation of this set can be easily understood by the accompanying diagram.

Using the D.P. 3T. switch A and A_1, the loose coupler or the single coils of different wave lengths with or without series condensor, can be selected.

When the switch blades are on the points 1 and 1_1, the loose coupler is used. When the switch blades are on the points 2 and 2, the single coils of different wave lengths without series condensor are used, and the secondary of the coupler can be used also as a single coil. When the blades are on the points 3 and 3_1, the above mentioned single coils are used with a series variable condenser.



This is the Hook-up of the Long and Short Wave Receiver Described in This Article. Note the Connections of the Special Switch in the Center.

In order to select a single coil of a certain wave length, a double pole multi-throw switch is constructed and used, the construction of which is described in the "Junior Constructor Section." With the use of this switch all dead ends are avoided.

As to the detector, either crystal or audion detector may be used. In the audion detector circuit, the capacity feed back system is employed. The changing from crystal to audion is accomplished by using telephone jacks and plugs, or the leads may be taken from C and D to D.P.D.T. switch and phones connected to it. When using crystal detector the switch B should be on point 4.

The points KM and SN are brought to the binding posts on the front of the panel

(*Continued on page 783*)

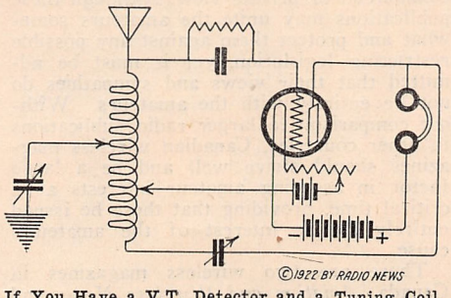
A Regenerative Receiver from a Double Slide Tuner

By W. F. ALLSTON

ALL ye radio bugs who have double slide tuners laid away on a shelf in the attic and covered with barnacles, oscillations, etc., take the old family dust broom, search out and renovate that once famous article and try a new trick that will make the old thing weep undamped tears of affection for you and sing songs from far distant lands.

Although this sounds like a fairly tale, it is true. To prove it, it is only necessary to follow the accompanying instructions and connect up a double slide tuner and variable condenser in place of an ordinary regenerative receiver. From the diagram, it is seen that the antenna and grid are connected to one end of the winding of the coil, the ground to one slider, the negative filament to the other slider and the other end of the coil is connected to the variable condenser and then to the plate.

The three circuits are tuned as follows: The antenna circuit is tuned by slider No. 1, the grid circuit by slider No. 2, and the plate circuit by the variable condenser. To aid tuning, another variable condenser may be inserted in the ground lead. For good results over a wave-length range of from 200 to 700 meters, a Murdock tuning coil may be used with two 43-plate condensers.



If You Have a V.T. Detector and a Tuning Coil, You Can Hook Them Up Like This to Obtain a Regenerative Effect.

The range of the set is about the same as that of any other regenerative receiver. Regeneration is brought about by varying the plate condenser until the circuit almost oscillates, or until there is the greatest amount of feed-back without being sufficient to sustain oscillations within itself.

The writer has had remarkable success with this circuit, and although there is nothing new about it, there may be some who have never realized its possibilities. It is easily incorporated in a portable set, allows the beginner to make a cheap regenerative receiver and gives the old timer something to experiment with.

Editor's Note:

For you fellows who struggle with a crystal detector to receive the radio concerts, this circuit will prove useful when you get a V.T. detector. By hooking it up as shown here, you will get the signals as loud as with an expensive set.

Correspondence From Readers

A REMEDY TO HONEYCOMB COIL TROUBLES.

Editor RADIO NEWS:

I have some information to give amateurs using honeycomb coils, which will enlighten them as to why their coils will not oscillate sometimes even though they are newly bought. I recently purchased six duo-lateral coils, whose turns are 200, 400, 500, 750, 1,000, and 1,500. The first three I use for Arlington time signals, and the last three for high powered C. W. stations. I was able to make the Arlington coils oscillate, and they worked fine. However, no matter how I adjusted the detector, I could not make the other coils work properly unless I reversed both connections in the ticker and secondary. I took the coils apart and found that they were so connected that their turns ran opposite to those of the other coils. I connected up the plugs on the coils so that their turns would coincide with the other four and that was the end of my trouble.

I suggest that amateurs using honeycomb coils check them up by the following method. Stand the coil upright and place a compass on top of it as shown in Fig. A.

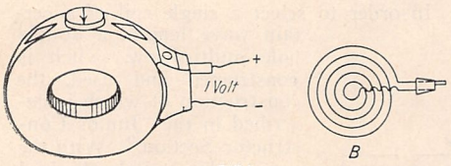


FIG. 1

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Connect the positive of a dry cell to the projecting part of the plug and the negative to the other terminal. The needle should point toward you. Do not use more than one or two volts and above all, do not use a storage battery. If the needle points away from you, the coil should be disconnected from the plug and connected up as shown in Fig. B. Your coils will work properly the next time you try them out.

ANTON THONGES, Radio 2BBA.
New York City.

POLICING THE ETHER.

Editor RADIO NEWS:

May I say some more about "Policing the Ether"? If so, I shall go ahead with my story.

The other night, I had the good fortune to listen in on the District Control Manager's set of the A. R. R. L. in this section, namely "8FE," and was surprised to hear the number of amateurs above the 200 meter wave-length, in fact 90 per cent. of them were extremely audible on 600 meters!

I placed a suggestion before the owner of this station, above mentioned, that to my way of thinking it would be a good idea to make up a number of circular letters (as per sample attached) to be sent to all amateurs heard above the 200 meter wavelength; a record should be kept by stations designated, for this purpose.

I frankly believe there are a number of "bugs" who do not know when they are above the 200 meter limit and a little "jar" in the shape of a circular letter would help them to realize the fact that they are above the limit, and this would reduce the wavelength and help prolong the life of Radio Amateurs in this Country.

I believe that if this article was brought to the attention of the Radio Clubs here, by its publication, a great step would be taken in saving one of our greatest American sports.

Of course the Clubs could take any method they chose of reaching these ether disturbers and "QRM" manufacturers, and I do not think it would be an expensive proposition to get up a few hundred of these circulars and follow them up.

I hope to see something done to keep these "birds" off Government waves, etc., etc.

NAME OF CLUB
.....192..
Radio.....
Your signals were heard on
..... Meters ..... 192..
A. M.
..... Audibility.....
P. M.

Do you realize that the above signals are driving a nail in the "Coffin" for Amateur Radio by not working on the Government allowance of 200 Meters?

Would you like to have your set abolished? No, of course not. Then it is up to you to get your set tuned up to the proper 200 meter wave-length.

There are a number of "Radio Clubs" in your vicinity that are willing to help you to tune up. Get in touch with some of them and let's help save Amateur Radio from the grave.

Yours for Amateur Radio.
Radio.....
FRANK J. HENRY.
Buffalo, N. Y.

Some of the Interesting Articles Appearing in the February Issue of Practical Electrics

Home Laboratory Switchboard. By H. Winfield Secor, Assoc. Member, American Institute of Electrical Engineers.
New Vibration Galvanometer. By S. R. Winters.
Building a Battery Motor. By B. Francis Dashiell.
Some Simple Electro-chemical Experiments. By Raymond B. Wailes.
Portable Electrically Heated Hypsometer. By S. R. Winters.
A Genuine "Rinktum" Motor.
An Electric Light for the Coal Shovel.

THE CANADIAN SITUATION.

Editor RADIO NEWS:

There is no national wireless organization in Canada which could assist amateur interests and protect them against restricting Government legislation. Canadian wireless publications are gradually coming into prominence, but these are issued with a commercial or private view. Although these publications may unite the amateurs somewhat and protect them against any possible restricting legislation, yet it must be admitted that their views and sympathies do not lie entirely with the amateurs. Without comparison to larger radio publications in other countries, Canadian wireless magazines should strive well and be a large factor in assisting amateur interests at a critical time, providing that these be issued entirely in the interest of the amateur's cause.

There are two wireless magazines in Canada, *Aviation and Wireless News* and *Canadian Wireless*. The former is issued as a commercial enterprise and in the writer's opinion, probably appears to be somewhat localized in its non-technical radio section.

Canadian Wireless is probably the most promising publication in Canada. But, being issued by Marconi Company men and financed by them, one wonders what interest the Canadian Marconi Co. has in the amateurs. Is their attitude towards us a favorable one? It has always been known, at least in previous years, that the Marconi Co. certainly would not grieve at seeing the amateur suppressed. If the writer remembers correctly, an attempt at the suppression of the American amateurs was made by that company several years ago. Probably the restrictions upon amateurs in England was due to Marconi influence.

Now the writer has the greatest admiration and respect for the editor of *Canadian Wireless*, and may say without hesitation that a man of more pleasing personality, better character and larger ability could not be obtained to look after amateur interests in Canada. But this editor's heart is in two conflicting places. Being under the restraint of the Marconi Company one wonders, again, what his stand would be if an attempt at the restriction of the amateurs was made at Ottawa. There is serious danger of such restriction being attempted at any moment. The increase in the number of licensed amateurs by 500 per cent. in one year makes this all the more probable.

What Canada needs is an organization possessing the same basic principles as the American Radio Relay League, issuing its own magazine, and not connected with commercial or private interests; and which would be ready at a moment's notice to provide all necessary opposition to any restricting measures that may be proposed at Ottawa.

Moreover, amateur radio associations throughout Canada should not be influenced by members who bear a hidden commercial or Marconi interest. If the name and constitution of any particular society supports the amateurs' cause, all professional radio men should be excluded. Of course, it is realized that a great many commercial operators are really amateurs at heart and had their initial experience as amateurs and considerable allowances should be made for these men.

Amateur and professional interests in any sphere can never combine, and in the realm of wireless, the amateurs' help to the country is NOT so insignificant that it should give place entirely to commercial ambition and enterprise.

If any attempt be made at separation from the American Relay League, it would be for the reason that Canadian amateurs must protect themselves against possible restricting Government legislation. What can the A. R. R. L., or any other American organization do against the legislation of another Government? If this fact be realized by the A. R. R. L., that organization should encourage and assist a distinct national wireless organization for Canada. Possibly the best manner in which this could be brought about would be to have a Canadian national convention of wireless amateurs in some centrally located city, and there with the help of representatives from the executive of the A. R. R. L., incorporate a national organization which would be maintained by amateurs throughout Canada.

In the matter of relay work, however, efficient traffic through Canadian stations solely, is not practical at the present time, although probably within a year or two all-Canadian relay work may be realized.

S. WEITZER.
Montreal. Canada.

(*Continued on page 760*)

Who's Who in Radio

No. 13 Rear Admiral WILLIAM H. G. BULLARD

IT was about 22 years ago that Admiral Bullard, then a young Naval Lieutenant, fresh from the Spanish-American war service, was first attracted by wireless. During his student days at Annapolis, electricity and electrical engineering interested him. These studies he carried on further, following his graduation. He soon became known as one of the "electrical sharps" of the Navy.

Wireless appealed to him, both as an electrical engineer and as a military officer. With his knowledge of electricity the military possibilities that lay in wireless were readily apparent, so he threw himself into the subject.

He is now director of the Navy Communications Service; he was the first superintendent of radio service from 1912 to 1916, which has since been enlarged to embrace all forms of communication activities. In that capacity he is head of one of the most extensive radio services in the world. More than 140 shore stations, 80 radio compass stations, five transoceanic stations and five air stations are under his administrative direction, in addition to the radio installation on all Navy department vessels.

He was in Media, Pennsylvania, December 6, 1866. In 1882 he was appointed a Naval Cadet from the sixth Pennsylvania district. He completed his four years' course in June, 1886, and on July 1, that year, was commissioned an ensign. He returned to the Naval Academy for four different tours of duty as a member of the faculty. Physics, chemistry and electrical engineering were the subjects he taught. In 1896 he was promoted to lieutenant, junior grade; three years later he was made

Rear Admiral William H. G. Bullard

a lieutenant and on January 1, 1915, was appointed a lieutenant-commander. February 1, 1907, he was again promoted, this time to commander. On October 1, 1912, he was made a captain and it was then he became associated with the Navy's newly organized radio communication service. In 1918 he was promoted to rear admiral, the position he still holds.

He originated, and for a period of four years from 1907 to 1912 was head of, the new department of electrical engineering at the Naval Academy. Scores of young Naval officers owe their knowledge of electrical engineering and their fondness for the science to the Bullard inspiration, and his text book "The Naval Electrical Text Book" is the standard in the course of Electrical Engineering.

But in the Navy, no matter what may be the scientific attainment of an officer, he has to perform the routine duties of the service. Hence, Rear Admiral Bullard has more than eighteen years of sea service to his credit, his last command before coming shore being in the World War as commander of U. S. Naval forces in the Eastern Mediterranean and charged with accomplishing the Naval terms of the armistice with Austria-Hungary. Under his command, certain Austria-Hungary battleships were taken over by the American forces. He further participated in the first allied commission to investigate conditions in Fiume and to report what measures were necessary to prevent disagreement among the Allies over the Fiume question.

In 1899, the year following the Spanish-American War, Marconi brought to this country from Italy three sets of his wonderful new wireless apparatus, the immediate purpose being to use them in reporting the International yacht races that year. The Navy department appointed a commission to observe and report on the working of

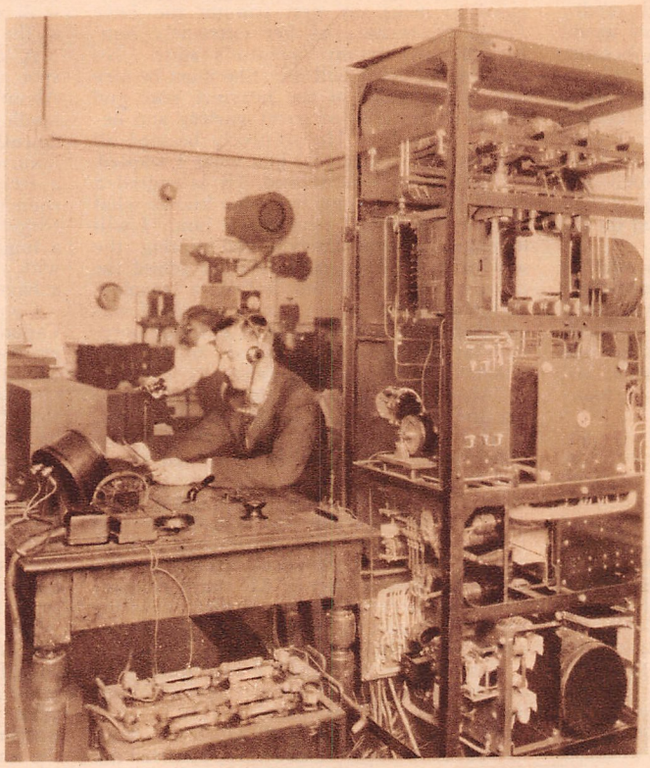
(*Continued on page 764*)

Radiophone Broadcasting of Weather and Market Reports

By S. R. WINTERS

RADIO telephony has displaced radio telegraphy as a vehicle for disseminating weather and market reports, which service was inaugurated by the United States Post Office Department on April 15, 1921. The change in the form of transmission has for its purpose a simplifying and popularizing of the service, the radio telephone lending itself to use in the absence of knowledge of the International telegraph code.

A radio telephone transmitting outfit, specially designed for the purpose, was recently installed in the United States Post Office Department building. It is the first unit of its kind to be placed in operation, the novelty of the equipment inviting descriptive text. This radio telephone, when functioning, puts 14 amperes in the antenna at 1,160 meters. The voice modulation approaches a state of perfection. Preliminary demonstrations in determining the capacity of the transmitter have resulted in throwing the voice in distinct tones, as far west as Bryan, Ohio, and southward to Atlanta, Georgia. Flexible is the transmitter itself, being equipped with three control switches. This liberality of control affords the employment of low or high powers on continuous wave, interrupted continuous wave, and telephone, with a frequency choice of



The New Radio Telephone Transmitter Installed in the Postoffice Building in Washington, D. C., for the Purpose of Broadcasting the Weather and Market Reports. This is the First of the Series Which Will be Installed to Cover the Entire United States.

four points between 800 and 2,000 meters. Four 250-watt power-tubes are in service in conjunction with a 50-watt power amplifier. The transmitter is provided with a multitude of automatic devices, including generator control, cut-outs, and an operator's switch. The latter is so ingeniously built as to make possible the control of the transmitting apparatus either locally or remotely. An interphone connection to remote-control points is an added convenience.

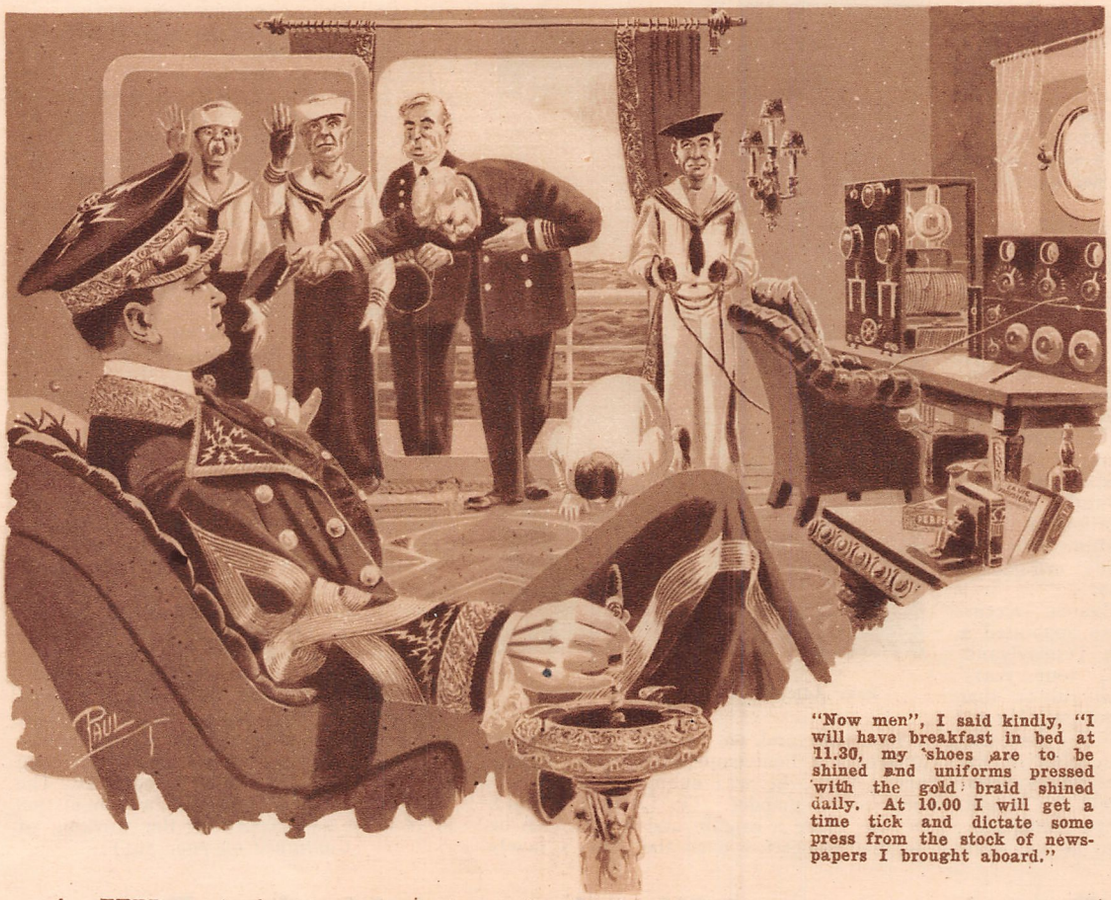
Compactness is a word that can be truthfully employed in describing the set-up. The transmitter is closeted behind a panel seven feet high, three feet wide, and two feet deep. The outfit is of rugged construction. The motor generator is of the three-unit design. A D.C. motor drives a plate-voltage generator at one end, while a combined excitor and filament generator is located at the other end. The plate generator furnishes 2,000 volts D.C. through the use of two 1,000-volt armatures. It is connected in series with a common electric field.

The abandonment of radio telegraphy in favor of radio telephony as a medium of broadcasting weather and market reports issued by the United States Department of Agriculture is reason for contemplating an expansion of the

(*Continued on page 764*)

Mr. Sparks at Sea

By RAYMOND F. GUY



"Now men", I said kindly, "I will have breakfast in bed at 11.30, my shoes are to be shined and uniforms pressed with the gold braid shined daily. At 10.00 I will get a time tick and dictate some press from the stock of newspapers I brought aboard."

AFTER graduating from a certain well-known school of wireless telegraphy in New York I knew my unqualified success was an assured fact, that I would be paid fabulous sums for visiting all of the great and sundry ports of the world and my services would be forever in tremendous demand, because I had read it in a magazine.

Forthwith I sallied gayly into the static room of a not unknown Wireless Telegraph Company in the vicinity of the school, with my shiny new first grade license in one hand and a huge and loudly ribboned smellerino in the other to keep pace with my new high position in the world. Was I sitting on the World? Ask Dad, he knows.

"Dave," well known around that office in those days as one who had to be outwitted to get into the Presence Supreme, spotted me as soon as I had made my entrance triumphant and immediately ushered me into the aforementioned Presence Supreme, Mr. John Jones, Hirer and Firer of many, many operators.

As I entered the office he was intently absorbed in a game of Dominoes with the office boy, but immediately I was announced he paid the boy his twenty cents and turning to me, greeted me with his widest and most ingratiating smile and bade me be seated in the comfortable morris chair, after which he presented me with a dollar cigar and told me he had been informed by Mr. Rally that I was soon to be available, inquired what ship I wished to make my ocean-going Debut on and the salary I wanted.

Knowing that the salary of other operators was Two-hundred Dollars ($200.00) a week for a start and not wanting to make them jealous, I modestly offered to give my services for this trifling sum. I could see his eyes light up like a brand new audion and he actually seemed to purr all over, his smile widening every minute.

"And what ship would you like to make your maiden voyage on?" he asked, very anxious to please.

"Oh," I replied, "several days ago I decided to make my first trip on the *Lake Frugality*, because of her extremely comfortable and roomy operator's suite. No ocean-going hack will do. She must be nice and comfortable in the heaviest seas and the food must be of great variety and beyond reproach." He positively beamed all over because I had told him what I wanted.

"You know," he replied, "it is indeed a relief to find an operator who knows what he wants so that I may please him. I will arrange it immediately," and suiting the action to the word he feverishly seized the nearest telephone and called a number. After a period of less than a minute I was startled out of my attitude of extreme boredom at these tiresome details to see him slump forward in a dead faint.

"Aha," thought I, "he got the right number the first time." I made a mental note to reprimand the black hearted corporation which would startle so gentle a soul thusly and summoning Dave, we administered the First Aid that no school is complete without. He soon recovered consciousness and I noticed the poor fellow bracing himself against another such shock (which I felt was quite unnecessary). At length he completed the arrangements and turning to me very ill at ease and embarrassed he apologized profusely.

"Oh, that is all right," I said kindly, "I am sure it will never happen again. When did you say my taxi would arrive?"

At length the Packard which he summoned arrived and he and Dave escorted me out, first insisting that I take all of the remaining cigars, which I was loth to do, naturally. Returning, they carried out my trunk for me and after a touching farewell, with many requests to write to them, I ordered Julius to the ship.

Well, since I wasn't paying for the taxi I informed Julius at the wheel that he could drive as long as he wanted, as I knew he would anyhow, but he would have to give me half. This settled, I sat back luxuriously and contemplated. How easy it had been. In a few years when I had seen the whole world, I would buy a farm in some Province, New Rochelle perhaps, like all old salts, and raise Tuna Fish Sandwiches.

My meditations were rudely interrupted by a great clamor and almost drowned out by a band which was playing, "Behold the Conquering Hero Comes." I sat up dazzled and almost swallowed my cigar. We were at the dock and this was the ship's company assembled to greet me and do me homage. Needless to say, I was surprised and delighted.

I alighted, first fixing up the little prearranged matter with my versatile and altogether extraordinary guide and informer, and was greeted by enthusiastic hand shakes and cries of "Vive Le Sparks, Long May He Wave." The Captain, a slightly built and sickly looking soul of about six feet four and weighing two hundred sixty or so, routed the smaller fry and with his red underwear showing most promiscuously, took my arm and we started up the dock at the head of the gleeful crew.

A description of this beautiful garden spot may not be amiss at the moment. About as long as a rope and as wide as a landlord's smile it was truly a Godsend to downtrodden fireman and mess boys. Two luxuriously appointed Tennis Courts with a free soda fountain at one side were surrounded by beautiful beds of pansies and forget-me-nots, while at the shore end was a lounge room for the coalpassers fitted up with rare oil paintings and draperies, truly a haven for them and their friends.

Going aboard on the escalator the gentle Captain escorted me to his suite, explaining at length that he had moved out so that I would be more comfortable, but that he had not had time to move all of his stuff. I told him it would be quite all right if he would attend to it without delay and not to feel badly about it.

Calling the stenographer who had been provided for me, I jotted down the ports I wanted to visit, the alterations to be made, and servants I would require, as advised by Mr. Jones. This done I called my staff of flunkeys and gave them their instructions as follows:

"Now men," I said kindly, "I will breakfast at 11:30 in bed, my shoes are to be shined and uniforms pressed with the gold braid shined daily. Assisted by you I will arise and get a time tick for the night watchmen (mates) to set the clock by. At the end of each watch you will waken the watchmen and engineers so that they may go off watch. In the afternoon I will see the movies which were brought aboard for

(*Continued on page 766*)

Larry Doyle's Wireless

By R. O'HEAD

THE reason foreman Casey had such disturbing difficulty holding men on section seventy-six at Big Sandy, was that while the foreman's shack was situated near the box-car depot, the men's bunkhouse was a mile from the track. Ever since these conditions were established there had existed pressing need of a means of rapid communication between the foreman's house and the bunkhouse. The railroad company when appealed to had with alacrity, rejected the idea that a telephone line should be built at its expense. The result was that when on Sunday, or in the evening, Casey was ordered to entrain his gang on the handcar and pump to mile-post eighty-four to discourage an incipient prairie fire, generally he arrived at the bunkhouse laden with a stock of invectives which he delivered to his tarriers in a manner that admitted of no flexibility of definition.

The "owld toimers" on the section knew there was only so much to it, and when that had been unbosomed, Casey could be depended upon to keep the peace until something worse happened. Newcomers, however, did not take kindly to Casey's method of broaching the subject when occasion required him to pavlowa a mile through the mud to marshal his forces for an assault upon a washed-out culvert and, in most cases, they jumped the job at the first explosion.

It was just after a couple of new recruits had pulled their freight that Larry Doyle, the telegraph trouble-shooter suggested to Casey that in this day and age the only correct thing to do was to set up a wireless telegraph between the bunkhouse and the depot. As Larry put it: "Although, Casey, you don't know the electric circuit from the circuit court, the day's forninst us when we will have to take to studyin' the Continental code an' the rumkorf coil if we expect to continue our connection with the railroads. Yes, Casey, soon you'll hear again the primeval axe of the pioneer resoundin' throughout the land chopping down the poles that have held up the cobwebs of commerce for the past nineteen hundred years."

Mulligan, who had been listening attentively stepped up to the foreman and whispered, "I wonder why it is they hire ships to bring more of them from Brazil?"

Pretending not to have noticed Mulligan's innuendo, Larry resumed: "And you, Mulligan, you'll never have any more use for a wireless telegraph nor a bird has for a bridge or a pig for a bib. Your face is as long as a letter of thanks, but that don't mean there's anything in back of it."

Although Mulligan could wield a pick with a finesse that was the envy of every man on the division, he realized well enough that at repartee he was no match for Larry. However, still doubting that Larry was just the right man to solve the problem of long distance communication between the depot and the shack, Mulligan, looking to Casey for support, remarked: "G'wan Larry, g'wan; you haven't done anything for twelve months but color a meerschaum pipe, but if you can make a wireless telegraph, why don't you make it and quit making speeches about it?"

"Don't listen to him, Casey," said Larry. "Leave it to me and I'll build you a wireless that will save many a sprint to the bunkhouse beyond."

Larry had a shack not far from the depot wherein he kept his emergency stock of wire and his tools. The place was floorless and was littered with a nondescript collection of odds and ends such as usually find lodgement in a trouble-shooter's shack. Also, this particular shack seemed to be a rendezvous for hibernating snakes and rats; to an extent that on one occasion prompted Mulligan to suggest to Larry that he extend an invitation to St. Patrick and the Pied Piper to spend a week-end in the place.

A couple of days after the before-mentioned scientific conclave took place, Larry was seen toting to his shack a couple of discarded four-gallon water coolers, each fitted with a spigot at its lower end.

That evening as Larry was busily engaged secretly, as he supposed, working out the details of his plan, he heard a suspicious sound on the outside of the shack. Cautiously turning 'round, he observed an inquisitive eye in a knot-hole. Quickly opening the door he discovered Mulligan before the latter had time to disappear into the night, and calling back the eavesdropper he crooned forth: "Is that you, Mulligan? Sure, you shouldn't be perambulatin' about of an evening without a compass. You never can tell where you are going at all. I believe you would do anything within the limits of the three dimensions to keep an honest lineman from contributin' to the scientific evolution of the telegraph, so I do."

Crestfallen, and with a feeling of guilt, Mulligan haltingly remarked: "Aw, Larry, sure it is myself that came all the way from the bunkhouse to see could I help you with your invention. Unbeknownst to the rest of them, I slipped away to come and hold the lantern for you, or maybe warrum the glue."

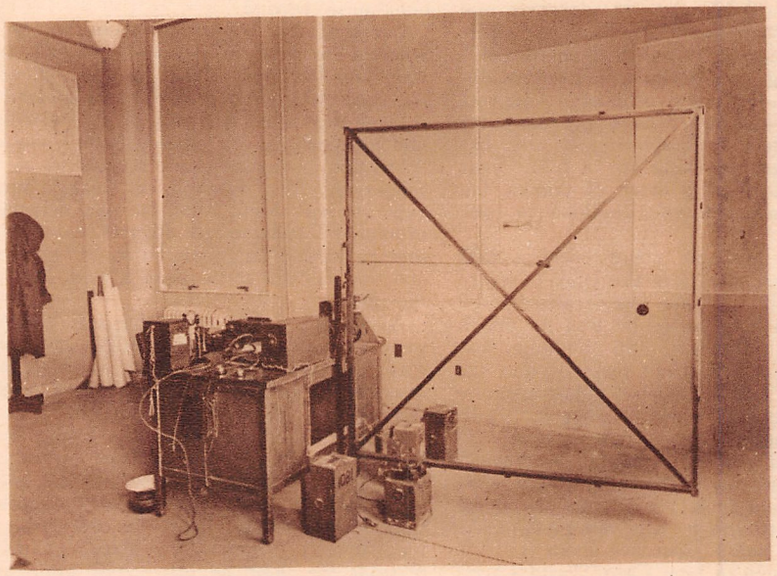
Mulligan followed Larry into the shack, and as the latter, ignoring the proffered assistance, remained silent, Mulligan proceeded to whistle a few seductive bars from "Maggie Murphy's Home," ostensibly for the purpose of creating an atmosphere of unconcern. And Larry, while displaying some hope-

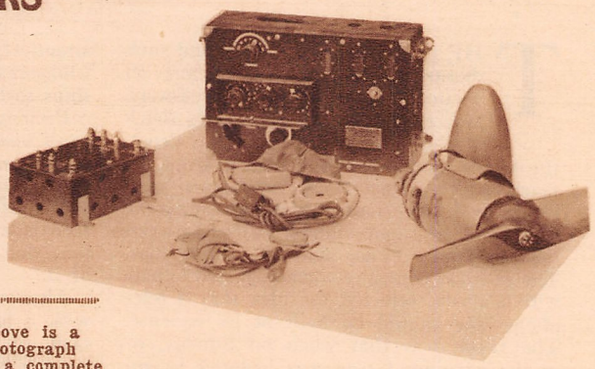
(*Cont. on p. 770*)

"You Seen That the Water Stopped Leakin' When I Turned the Spigot Handle, and That the Message Sent Was Number '8'. Now Look at the Schedule and See What it Says".

Airplane Phone and Spark Sets

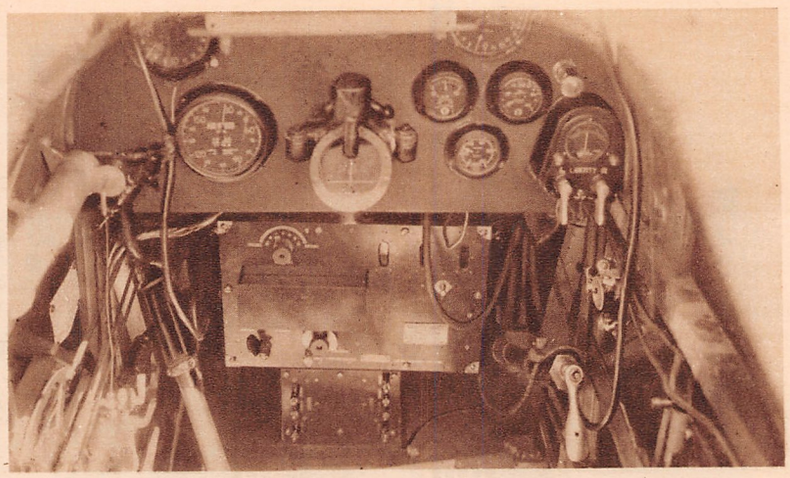
By S. R. WINTERS





Above is a photograph of a complete radio telephone equipment for airplanes. On the left may be seen a direction finder used by the signal corps to ascertain the position of airplanes.

NOW that the veil of secrecy has been lifted from the maneuvres of the late World War, the Air Service of the United States Army is free to release information relating to radio telephony and radio telegraphy as it functioned with aircraft. The hitherto cautious statement, "Confidential! For Official Use Only," has been blurred and the word "Released" substituted therefor, with reference to descriptions of airplane radio telephone and telegraph sets. Knowledge of this wireless equipment may serve a useful peace-time application, and in the event of the Conference on Limitation of Armament failing to curtail military agencies on land and in the air, a description of the apparatus used in the recent conflict may stimulate inventive minds to further improve warring airplane-radio appliances.

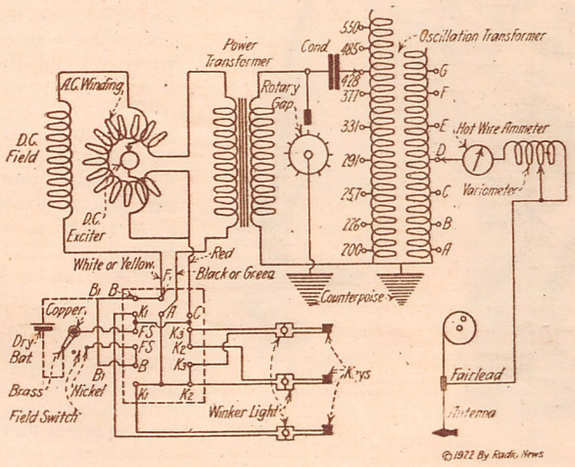


In a One-Man Plane the Telephone Set is Installed as Shown Here so That All Controls May be Adjusted by the Pilot.

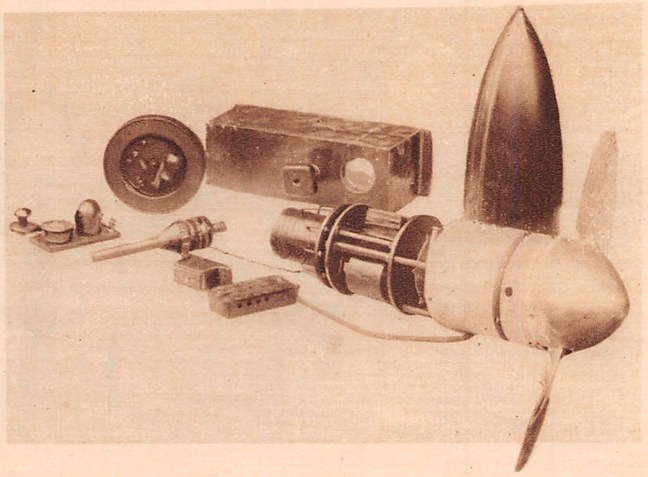
An airplane radio telegraph transmitting outfit type SCR-73, was designed and put into service on fire-control aircraft. It is a damped wave form of sending equipment, deriving its power from a self-excited inductor type alternator, driven by a special constant speed air fan, or occasionally when employed for training purposes, its source of operation is a fixed blade wooden air-fan. The alternator, rotary spark gap, potential transformer, condenser and oscillating transformer are all self-contained in the stream-line casing of the alternator. The latter is usually mounted on the under side of the fuselage of the air-going machine where it will be in the path of the wind currents created by the propeller. Three radio telegraph sending keys, field and battery switch, a dry battery and its container, a variometer and an antenna reel, are the units of apparatus mounted inside the fuselage.

This transmitting set, in the main, is a simple rotary gap indirectly excited spark equipment provided with nine taps on the inductance coil of the closed oscillating circuit to afford an equal number of different wave lengths. There are five different toothed discs for the rotary spark gap to give as many different signal tones. This twofold variation renders possible a variety of combinations of wave lengths suggestive of a brand of commercial pickets—or 45 kinds, to be exact. This wide range of wave length and tone makes it feasible to operate a large group of fire-control airplanes in a restricted area without individual interference. The adjustment of the wave lengths and tones of the closed oscillating circuit is not within the scope of the pilot or observer, being a tack for execution on the ground before the machine takes to the air. Also, adjustment of the open or antenna oscillating circuit is effected before the aircraft makes its ascension. The only harmonizing force under the guidance of the observer in the air is that performed by a variometer

(Continued on page 772)



On the right is a spark transmitter, remarkably compact. The high tension transformer with the oscillating circuit and rotary gap are enclosed in the shell-shaped cover, which is removed here. The key, variometer, H.W. meter and accessories may also be seen. On the left is the hook-up of this set.



THE BEACH RADIO CLUB OF TORONTO, CANADA.

The club has been in existence for nearly a year, but it was only this season that it sprang into real activity. Now it is full of pep and go with the result that the membership is growing rapidly and we are gradually bringing radio into the eye of the beach public.

At a meeting a month ago the constitution was drawn up and the main idea of the policy was to diffuse knowledge among the people as well as amateurs. Accordingly, as a direct result the club held a public concert in a spacious hall the novel feature being the reception of wireless music on a four step amplifier in conjunction with a magnavox. The music was perfect and the intensity was about as loud as an average phonograph. We sent up an artist especially, who sang into the transmitter, was heard by the audience in the hall, and then came down personally and sang again, the two renderings compared favorably. The whole thing was an immense success and 300 people enjoyed it. Since then we have been asked to put on four different concerts of a similar nature so here is a good hint to other budding clubs.

That concert resulted in six new members, so you can see it gives results.

Address all communications, Radio 3RF, 14 Victoria Prk Ave., Toronto, Ont.

ELIZABETH (N. J.) RADIO CLUB.

At the last meeting of the Elizabeth Radio Club at 18 Rankin St., Mr. E. Gundrum was elected secretary.

The club now plans for permanent club room and if the room is purchased the club will install a ½ K.W. spark station for the purpose of relaying.

The club expects to become affiliated with the American Radio Relay League, application for the League has been sent for.

Mr. Davidson (2BLO) was appointed traffic manager for the club. Any radiograms for Elizabeth, N. J., please give to 2BLO.

The club is taking great interest in the new rules of the executive Radio Council. The club purchased a wave meter for the adjusting of instruments of various member transmitters.

The purpose of this club is to promote more interest into the radio game and to bring together more radio amateurs in this section.

The club wishes to accommodate more members, you do not have to have a high power set to join our club. We want to help all Elizabeth Radio hams out, so please come around to some of our meeting, the dues are so small that any ham can pay. So please take more interest in the radio game than to just sit around and listen in, come around and learn the code, free lessons by Radio Instructors.

All Elizabeth amateurs desiring to become members please address all communications to Mr. E. Gundrum, Secretary, 303 Cherry St., Elizabeth, N. J. Radio Call 2BXY.

THE STATEN ISLAND RADIO CLUB.

Our club is progressing very rapidly and we have twenty-six members enrolled. Radio concerts are received at the club's headquarters on Mondays and Wednesdays at 8:00 P. M. for the benefit of people living on the island to become interested in radio telephony reception. Mr. Gropp, our president, has loaned his regenerative receiver, three-step amplifier and Magnavox for these occasions. Everybody welcome provided an appointment be made with the club. We are now installing a 5-watt radiophone set and a triple honeycomb receiving set. New sending sets are being installed by some of our members. Among them being 2AMO who has his 10-watt C.W. set working.

On December 2, 1921, an annual toast was held at its headquarters in which Mr. Van Pelt, our able bodied vice-president and first class "brass pounder" presided as toastmaster. We all enjoyed a good time. After the refreshments we had a few good speakers talk on different matters pertaining to radio telegraphy and telephony. The most interesting speaker of the night being our speed king and treasurer, Mr. Pascal, who gave a good talk on "Simple Radio Frequency Amplification." 2ACZ is installing a radiophone set with which he expects to give the people on the island some very good musical concerts in the near future.

All persons in this vicinity who are interested in wireless please communicate with the Staten Island Radio Club, 24 Osgood Ave., Stapleton, Staten Island, N. Y. Meetings are held on Friday evenings at the Staten Island Radio Laboratories at 24 Osgood Ave., Stapleton at 8 P. M. Those who wish to become members please call some Friday evening or write us.

RADIO CLUB OF LONG ISLAND.

The Radio Club of Long Island has held several meetings at the offices of the Ship Owners' Radio Service, 80 Washington St., New York City, and likes its new headquarters very much. The meetings, held every other Tuesday, have been very well attended.

At the meeting held on November 15th, Mr. Ferguson, the president, announced that he had so arranged that any members holding amateur licenses, who wished to do so, might take turns standing watch with the regular operator at 2CAP, the Ship Owners' Radio Service amateur station. This was the chance for an interesting experience, and eleven licensed members took advantage of it. The station is located at the above address. The transmitter consists of an excellent Kilbourne & Clark ½ K.W. 500 cycle ship set with which some very good work has been done. The receiver is a Sorsine tuner with detector and two steps.

At the meeting of November 22nd, after the regular business was finished, the members of the club listened to a very interesting talk on code learning by Mr. Berrell of the Ship Owners' Radio Service. He explained his method of teaching sound-reading of Morse. By his process a beginner can memorize the code in a fraction of the time usually taken. After the lecture the club was allowed to inspect a very compact and efficient four-tube C.W. transmitter which was being constructed in the shop.

Recently a code class was organized under the leadership of Mr. Miller, 2GA, so as to help the beginners or slow-speed fellows to get their licenses. The class meets at club headquarters every Monday and Thursday evening at 7:30 P. M. Mr. Miller found himself unable to continue so the class is now in charge of Mr. Edward Fenn, the treasurer.

PHILADELPHIA AMATEUR RADIO ASSOCIATION.

The Philadelphia Amateur Radio Association held its last regular meeting on December 19, 1921, in the Widner Memorial Library, 1200 North Broad street. Dr. Christine called the meeting to order and read an article from a magazine and gave a welcome to the visitors. The President chanced off a DuBilier mica condenser which was given to the club by Mr. Van Horn of the Phila. School of Wireless Telegraphy. Prof. Knoll read a paper on relief from QRM. Mr. John E. Delp also read a paper on an improvement regarding the English Amplifying circuit. A paper written by Mr. Gooding of Wilmington, Delaware, was read by the president on fixing Wilmington as a relaying station for messages going south. Chief-Elect Danniels read a paper on the Armstrong Auto-Heterodyne circuit and exhibited some photographs. The attendance was very large. There will be no meeting on Jan. 2, 1922. (Signed) J. W. Forsyth, 6543 N. Lambert St., Phila., Pa.

CORTLAND RADIO LEAGUE.

The first meeting of the Cortland Radio League was held in the Y. M. C. A. building, Dec. 14.

The following officers were elected: President, Paul G. Baldwin; vice-president, Arthur Lamien; secretary, Joseph Briggs; treasurer, Roger Greenman; inspector, Edward Little.

At present there are sixteen members and several more are expected to join. Harry Tayntor acting in behalf of Sec. Twichell offered the young men a room for their meetings and gave them permission to install the League's apparatus in the Y. M. C. A.

The next meeting will be held on Wednesday, Dec. 28, and will be devoted principally to code practice and theory.

RADIO CLUB OF ROCHESTER, N. Y.

This new organization is the result of the uniting of the several clubs in Rochester into one body.

On December 9th a committee from the Triangle Radio Society met with representatives of the Rochester Radio Club and formed the new club. Practically the entire membership of both clubs submitted applications for membership in the new club after both of the older clubs had dissolved in favor of the new organization.

It is greatly desired to have every eligible amateur, whether operating a transmitter

(*Continued on page 758*)

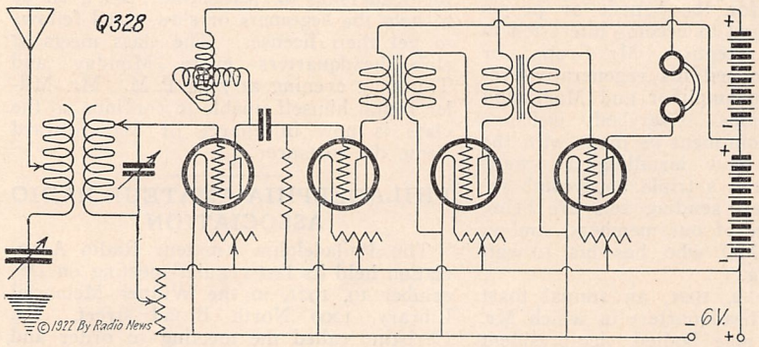
THIS Department is conducted for the benefit of our Radio Experimenter. We shall be glad to answer here questions for the benefit of all, but we can only publish such matter of sufficient interest to all.

1. This Department cannot answer more than three questions for each correspondent.

2. Only one side of the sheet should be written upon; all matter should be typewritten or else written in ink. No attention paid to penciled matter.

3. Sketches, diagrams, etc., must be on separate sheets. This Department does not answer questions by mail free of charge.

4. Our Editors will be glad to answer any letter, at the rate of 25c for each question. If, however, questions entail considerable research work, intricate calculations, patent research, etc., a special charge will be made. Before we answer such questions, correspondents will be informed as to the price charge. You will do the Editor a personal favor if you make your letter as brief as possible.



This circuit with one stage of radio frequency amplification before the detector is very sensitive and greatly increases the range of reception.

VARIOCOUPLER CONSTRUCTION.

(321) Leigh Brearley, of Guelph, Ont., Canada, asks:

Q. 1. Please give data for making a 600-meter variocoupler?

A. 1. A 600-meter coupler should be made as follows. Primary, 100 turns of No. 22 D.C.C. wire, wound on a tube 4 in. in diameter with taps every turn for the first 10 turns, and every 10 turns thereafter. These should be connected to two switches. Secondary should consist of a wooden rotor wound with 60 turns of No. 26 S.C.C. wire shunted by a variable condenser for tuning.

Q. 2. How far is it possible to transmit with a buzzer?

A. 2. If a low resistance aerial is used, with six volts as a source of power, the range of about one-half mile may be obtained under good conditions. See hook-up on page 540 of the February, 1921, issue of RADIO NEWS.

INFORMATION.

(322) Dudley Woodard, of Greenfield, Mass.

The address of Mr. P. W. Lister is 1167 Wheelock Ave., Detroit, Mich.

LOOSE COUPLER REGENERATIVE SET.

(323) John W. Harvey, of Burrwood, La., wants to know:

Q. 1. Is a regenerative receiver made with a loose coupler and two honeycomb coils, used instead of variometers, as efficient as a standard honeycomb coil set?

A. 1. Yes, such a set would prove as good as a standard HC coil set, provided the proper coils are used with a small condenser shunting the secondary of the coupler and the grid coil.

TICKLER COIL FOR A LOOSE COUPLER.

(324) Ralph Hettrich, of Palmer, Nebr., would like to know:

Q. 1. How could I make a tickler coil to use with a loose coupler?

A. 1. To obtain a regenerative effect with a loose coupler you need only to connect the variometer in the plate circuit of your detector tube.

GROUNDLESS RECEPTION.

(325) Clifford Welch, of Alvinston, Ont., Canada, writes as follows:

Q. 1. Would the efficiency of a short-wave regenerative set be impaired by leaving it in a workshop that is exposed to the weather?

A. 1. Most probably the efficiency of your set would be greatly affected if it is subjected to temperature changes, for the wood may crack and the windings may become damp, altering the insulation.

Q. 2. Can you explain why I sometimes receive signals with the ground wire disconnected from my set?

A. 2. It is quite common to receive strong signals without a ground, for the capacity effects between the set and the ground act somewhat in the same way as a counterpoise would. If the intensity of the signals is the same with or without your ground connected it is probably that your ground connection is no good and offers a very high resistance. In this case, the set functions constantly as explained above.

Q. 3. Can I construct a loop aerial that will give me the same results as my outside aerial, which is 120 feet long

A. 3. Unless you use a special circuit with radio frequency amplification, a loop aerial would not be as efficient as your regular antenna.

PRIMARY TUNING CONDENSER.

(326) George Hamilton, of Edmonton, Alta., Canada, wants to know:

Q. 1. If, in the circuit given in the article "The Loose Coupler in the V.T. Set", in the November issue of RADIO NEWS, a 4,000-meter loose coupler is used instead of one of 2,500-meters tuning capacity, would the range be increased to 4,000 meters?

A. 1. Yes, the range would be increased if the design of the receiving transformer is such that it can tune up to this wave-length.

Q. 2. Would a 43-plate variable condenser in the ground circuit of this hook-up improve the range at all?

A. 2. No, the range would not be increased, but on the contrary, decreased, if the condenser is in series. If you wish to increase the wave-length range of the circuit, you should connect the condenser across the primary.

RADIOPHONE.

(327) Wallace Howard, of Boulder, Colo., would like to know:

Q. 1. What solution is used in the jars of an electrolytic rectifier?

A. 1. The solution used in such rectifiers is a saturated one, with ammonium phosphate.

Q. 2. Which would be a good hook-up for a two-tube radiophone set?

A. 2. The best hook-up for a two-tube phone set was given with all the data on page 690 of the June, 1920, issue of RADIO NEWS.

Q. 3. I intend to use, for modulation, a few turns of wire connected to the microphone and wound around the aerial inductance would this system be efficient?

A. 3. We do not advise you to use this system of modulation, which will not give you very good results on account of the small percentage of energy which will be modulated. For best results, we suggest that you use the hook-up mentioned above.

RADIOPHONE RECEPTION.

(328) Hamilton Baluss, of Lock Haven, Pa., asks:

Q. 1. Please give a hook-up of a radiophone receiver using one stage of radio frequency amplification, detector and two-stage audio-frequency amplification.

A. 1. This hook-up appears on this page.

Q. 2. What is the difference between the Paragon and the Westinghouse hook-ups?

A. 2. The Paragon hook-up consists of three circuits with secondary tuned by means of a condenser, while the Westinghouse is a so-called single circuit tuner, with a condenser in series in the aerial circuit, the same inductance being used as primary and secondary.

COUNTERPOISE.

(329) George N. Schafer, of Kansas City, Mo., writes us as follows:

Q. 1. What kind of a counterpoise should be used with a cage aerial 65 feet long and 30 feet high?

A. 1. The best type of counterpoise to be used is the one that is erected in the shape of a fan, horizontally stretched under the aerial and as far as possible from it, but at least 3 feet or 4 feet from the ground. No ground connection is needed if a counterpoise is used.

Q. 2. Would an aerial running east and west receive as well messages sent from stations located north and south?

A. 2. Yes, this short aerial would be practically as efficient for stations located north and south as well as for the others, as only long aerials have a marked directional effect.

R. A. C. TUBES.

(330) J. Schweinfest, of Anaheim, Calif., wants to know:

Q. 1. Where can I buy Myers tubes?

A. 1. Myers tubes may be bought from the Radio Audion Co., 90 Oakland Ave., Jersey City, N. J.

LOOP AERIAL.

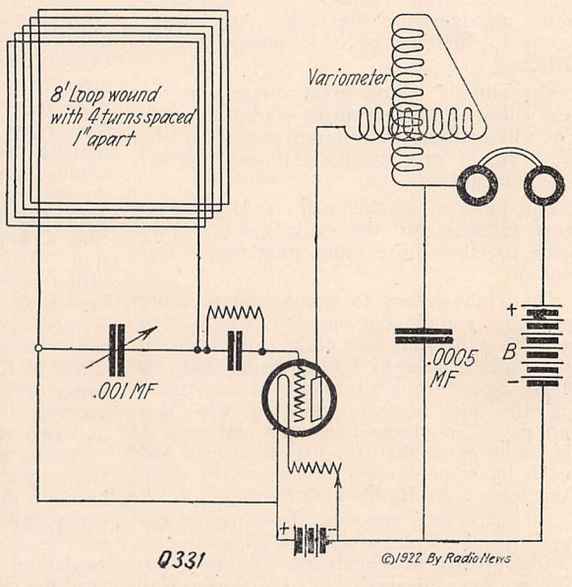
(331) Marcel Papin, New York City, N. Y., asks:

Q. 1. I have an indoor loop aerial 8 feet square wound with No. 20 wire can I receive the WJZ radiophone with one tube, using this loop? If so, please give hook-up.

A. 1. Yes, it is possible to receive the WJZ station with your loop aerial and one V.T. The hook-up appears on this page. For best results, we would advise you to use a variometer instead of spiderweb coils.

Q. 2. As a rule, can general hook-ups published, to be used with outdoor aerials, be applied the same way for loop aerials?

A. 2. No. When loop aerials are used, special circuits are necessary and are generally different from those used with an outdoor aerial.



If Not Too Far From a Radiophone Broadcasting Station, You Can Use a Loop and Receive the Signals Quite Clearly Using This Hook-up.

MURDOCK

radio necessities

No. 56

MURDOCK REAL RADIO RECEIVERS have delivered complete satisfaction, on a "money-back" basis for 14 years. Those years of experience have so simplified and perfected our production that there are today no receivers quite so good at so low a price.

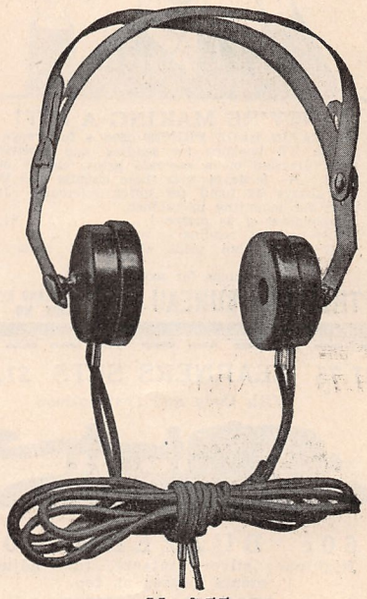
The latest Murdock achievement, the No. 56 Receiver, is a highly sensitive instrument which retains all the rugged strength of previous types. Important features are, the improved comfortable headband, the "Murdock-Moulded" ear pieces shaped to exclude outside noise, and the moulding of all parts into one durable unit.

All models of Murdock receivers are sold with free trial offer and money back guarantee. Use them in direct comparison to any other phones for 14 days. Make any test you wish. Then at the end of the two weeks, if the Murdock Phones are not entirely satisfactory, return them and your money will be refunded!

Many of the complete "ready-to-operate" wireless sets now on the market include Murdock Phones as standard equipment. If the set you buy does not, be sure you get a set of Murdock receivers to complete your station. We strongly urge you to go to your dealer and convince yourself of the quality of Murdock receivers, by actual examination, before you buy. Prices $4.50 to $6.00.

Murdock Phones are the standard bearer for a complete line of "Made - by - Murdock" radio parts and instruments. This includes the famous Murdock condensers, couplers and the new Murdock Rheostat at $1.00.

Send for Free Catalogue.



No. 55

WM. J. MURDOCK CO., 50 CARTER ST., CHELSEA, MASS.

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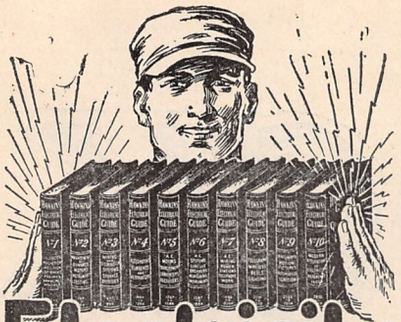

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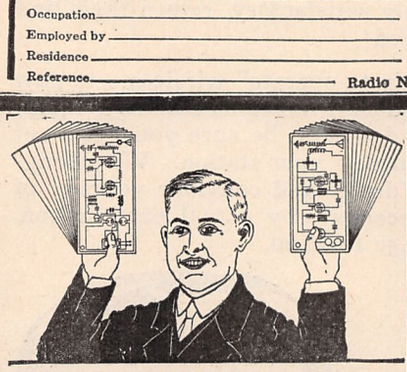

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The "A" Battery Problem

WHAT type of battery is best adapted to Radio uses, particularly with the new receiving sets?

So swift has been the advent of various styles of apparatus, and so sudden the demand, that until recently there have been no batteries on sale which completely cover the requirements.

Hence we see the strangest varieties of battery equipment doing duty in make-shift fashion, whereas the requirements are very simple and should be simply met.

We see intelligent amateurs worrying over "Christmas tree batteries" that will not deliver and then we catch glimpses of other amateurs trying to carry home extra heavy boxes full of bargain "junk" made over for "radio purposes" and sold at half price or less; the "making over" consists of modifying the terminals of rejected batteries made originally for starting purposes. The weight is impressive and junk is cheap. The showdown comes in due time!

Weighty junk, however cheap, is not solving the problem, and yet you cannot blame the amateur who has struggled with the toy stuff for falling for the big mystery all covered over with jet black goo and pushed on him by his regular dealer. He does not stop to consider that there must be a reason why the price is so low, but as a matter of fact he has not been able to get the right battery at the right price, and a battery he must have.

Now for the problem. The requirements are: 1st In most cases the battery should be easily portable, meaning that the weight should not exceed 35 or 40 pounds and a suitable handle should be provided.

2nd The discharge rate should be uniform, which means the best of material and workmanship — in other words, quality throughout.

3rd The plates must be of a type precisely adapted for radio work.

4th The terminals must be adapted for permanent acid-proof connections and for quick temporary connections at the will of the operator.

5th The whole job should be neat and the parts readily accessible, making the user independent of the service station.

6th The individual cells of the battery should be separately sealed and placed without compound in battery box.

7th The filler openings should be large to facilitate the use of the hydrometer, as it is the one best way to determine the battery's condition.

8th The plates must be porous, yet very hard, and the groups connected with heavy pure lead links.

9th The capacity is a matter of relative convenience. Too great capacity means too heavy to be portable. Better have two batteries than a too-heavy one, then one is always in prime condition. Only those who have encountered the nuisance and useless costs of getting service on heavy batteries fully appreciate what this means. In other words, two 50 A.H. batteries are more practicable than one 100 A.H.

10th The charging rate should be suitable both for home-charging, as with the small Tungar sets and for service station charging.

The price must be as low as is consistent with the above qualities.

Occasionally it is desirable to provide large capacity batteries, as for instance, where several vacuum tubes are in constant use.

In such cases a charging equipment is essential so that the batteries need not be portable, hence larger batteries are usually employed, of 150 A.H. or more capacity.

A conspicuous installation of this class is that of the New York *Times*, which was standardized only last summer, after long and unsatisfactory experience with various batteries not precisely adapted for radio work.

Here, as everyone knows, the conditions are most exacting, and after six months of 24-hour service it is found that the same size and weight of battery that would give from 90 to 150 ampere hours of service for starting or lighting will yield more nearly 200 A.H. as adapted and used for radio work, except when a large number of tubes is used with one battery.

Some of the precautions necessary in the manufacture of a really successful and satisfactory radio battery may be of interest to those who take pride in their outfits and like to know what they are made of.

As you know the positive and negative plates of each cell are separately "grouped" and the individual plates kept from touching, by "separators." The best of these are Port Orford cedar, ribbed and grooved and then chemically treated by special processes which, the test of time has proven, add to their life and efficiency.

These separators must be absolutely uniform in thickness and density, otherwise the plates become spotted and many troubles arise. Therefore, the separators are most carefully "candled" and inspected. Likewise the plates are carefully tested and then, when assembled and filled, they are charged and discharged, and the rate carefully checked up for uniformity, etc.

These precautions apply to high grade batteries and of course a battery fit for the niceties of radio work must be of the highest grade.

One interesting development of actual working tests made during the past year is the "twin battery" for radio work. As everyone knows, the voltage of a storage battery is not constant, but diminishes steadily during discharge.

The variation is not large during most of the period, but there is liable to be a very appreciable if not serious drop toward the end, and this often very aggravatingly occurs just at the most inopportune time.

To obviate such a contingency it has been found that two batteries, each six volts and of similar capacity, give excellent results with a two-throw switch for alternatingly putting either in the circuit.

A modification of the "twin six" radio battery is the "double six" or 12-volt battery with a special switch for putting either half in the circuit.

The disadvantage of the "double six" is its weight and the same results may be had by using two smaller capacity six-volt batteries with the same switch arrangement, each six-volt unit being portable for separate charging.

To sum up, it would seem that maximum service for minimum outlay of cash is to be found in the portable six-volt, seven-plate special Radio battery (preferably a pair of them, though of course, an extra battery can be added at any time).

A properly made radio battery should give excellent service for a number of years if given ordinary attention, the same as required for a lighting or starting battery.

The New CROSLEY Variable Condenser

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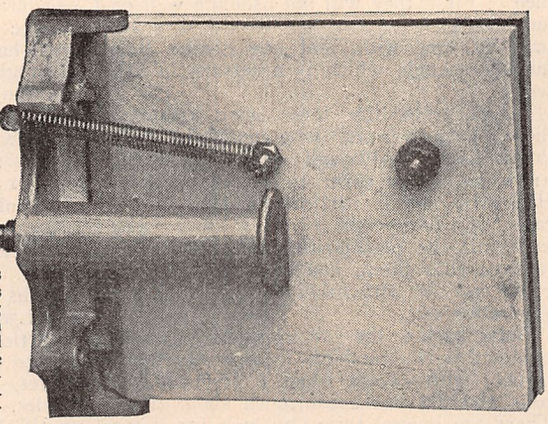
MODEL "C"



The principle of this instrument needs no introduction. Thousands of the Crosley Model "A" Condensers have been sold with uniform satisfaction. The Model "A" is conservatively rated at .0005 Mf. The new Model "C" is conservatively rated at .0012 Mf.

While the Model "A" was made with wood frame and laminated wood plates the new Model "C" has ground porcelain plates with die cast frame. It is as efficient a piece of apparatus as you could desire. For tuning C.W. and for power transmission it cannot be equalled. It is tested on one thousand volts before shipment. No body or hand capacity. Low resistance due to absence of spring contacts, copper plates, brass binding posts, etc. We call it the "sensation" of radio—"Better—Costs Less".

Every CROSLEY VARIABLE CONDENSER is GUARANTEED to give absolute satisfaction or money refunded.

The CROSLEY VARIABLE CONDENSER is now made in three styles:

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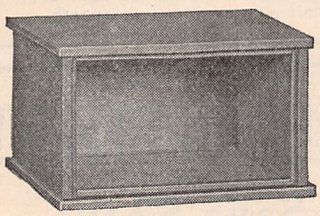
Model "B" with wood plates and die cast frame.
(Both models have the same capacity—.0005.)

Model "C" as illustrated—capacity .001—porcelain plates, die cast frame, etc.

Prices as follows:

	Without knob and dial	With knob and dial	With knob and dial mounted in cabinet
Model "A"	$1.25	$1.75	$2.50
Model "B"	1.75	2.25	3.00
Model "C"	2.25	2.75	3.50

Crosley Cabinets



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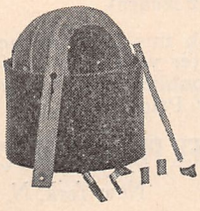
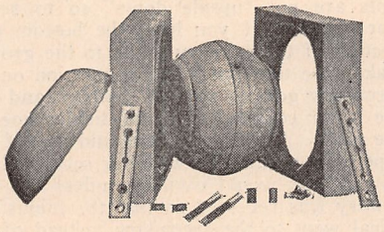
Crosley Vario-Couplers



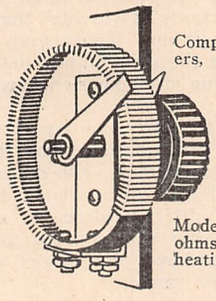
Consists of formica tube, rotor and brass hardware. Price, complete as shown in illustration not wound or assembled, $1.50. Stator only 40c

Crosley Variometer Parts



Consists of two stators, one rotor, the necessary hardware as shown in illustration. Shaft for knob and dial is 3/16" diameter. The wood parts are furnished either in poplar or mahogany. Price of Variometer parts, using poplar wood, $1.50. If wood parts are made of mahogany $1.75

Crosley Rheostats



Complete with knob, pointers, etc., as shown in illustration.

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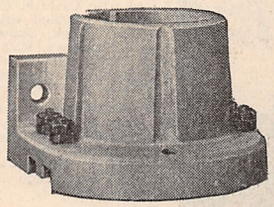

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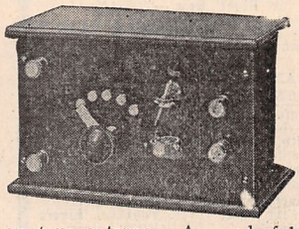

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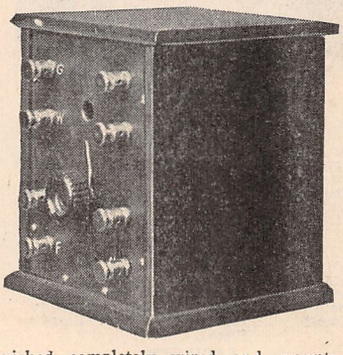

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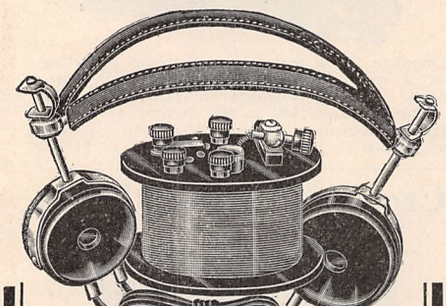

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Do You Know Your Honeycomb Coils

By GEORGE R. ROBSON

MANY amateurs have tried honeycomb coils for amateur reception and have found them unsatisfactory. When asked what the matter is with them, they will usually bring up the two following arguments: First, they will not oscillate well on amateur wave-lengths, and second, they are hard to tune with, and one cannot tune quickly enough, which is necessary in DX work.

In all probability these same amateurs did not keep their coils long enough to really know them. Although one must really know his set in order to keep it working efficiently, this is particularly true in the case of honeycomb coils. Once you know all the peculiarities and know how to tune with them, you can run a honeycomb coil set with as much ease as a regenerative set.

Going back to the first argument of oscillating, this is something I never had much trouble with except when I first had the coils and did not know much about them. There are several things to look for if the set does not oscillate properly. Try grid condensers of various capacities; see that the leads from the coils do not cross each other; have the grid condenser as near to the grid connection as possible. In damp weather the straps may become wet and thereby short circuit the coils; this will make oscillating difficult. I dried and shellacked the straps, thereby overcoming this trouble. Examine the wires on the honeycomb coil holder which connect the holder to the binding posts in back, as they might be broken. I had this trouble once as the wire had become broken inside the insulation and it was quite a while before I found the cause of the set not working. Sometimes, but very rarely, the coils do not make perfect contact with the holder; make sure the coils are not "upside down" so to sepak. For instance, if you have the bottom connection of the primary going to the ground, make sure that the lower connection on the secondary goes to the "A" battery, and that the lower connection on the tickler goes to the plate. Another amateur and myself had a peculiar occurrence with our sets. Neither of our sets would oscillate unless the "A" battery was reversed so that the minus terminal went to the secondary instead of the plus. This being contrary to theory, we could never see through it. One bulb that I had was so critical that it would not oscillate properly unless I had a grid lead of a certain size in the grid circuit. A different hook-up will often make all the difference in the world.

All these things can be easily remedied, so, take a good look at your set, and, noticing the various "causes of trouble" that I have mentioned, fix it up. There may be others, but these are the chief things that I have loked for during my experience with honeycomb coils.

In my hook-up the primary condenser shunting the primary is not necessary, but it works a little better with it. On my set, I rarely used it, as I just set it where amateurs came in best and left it there. A .001 mfd. condenser is better than a .0005 mfd. one across the secondary; the larger capacity gives a greater range.

The second argument, that honeycomb coils are hard to tune with and that one cannot tune quickly, is all wrong. I have used both honeycomb coils and regenerative sets and I will say that I can tune just as quickly with my honeycomb coils as with the regenerative set. It may be because I am more familiar with the coils, but that is just what I am trying to bring out. If one knows his honeycomb coils and knows how to tune with them, they will work all right. The secondary condenser is the only one that needs to be varied to tune in the various stations. The tickler coil, of course, has to be moved frequently to vary the oscillations. I was always able to quickly change when a station was fading, but always had trouble with the "ones" swinging, although I could keep on reading them by changing to a different wave-length. I could make this change just as quickly as I could with a regenerative set, and this is an important change in copying DX stations.

As to what coils to use, I can not say. The only way is to try and see which coils work best on the wave-lengths desired. It all depends on the bulb and the size of the aerial. With one bulb on amateur wave-lengths I used L25 primary, L35 secondary, and L50 tickler. With another bulb, I used L75 tickler. One amateur whom I knew had to use an L100 for tickler on amateur waves, while another used only an L35 tickler. This is one point which cannot be specified, and must be determined by the amateur in experimenting until the right coils are found.

During three months, with a one-wire aerial, 75′ long and 30′ high, one bulb and honeycomb coils, I heard 2 "nines" (9ZL, 9XM), 35 "eights," 2 "fours" (4EY, 4EA), 15 "threes," about 200 "twos," and 40 "ones"; NSF and KDKA also came in very well. I always prided myself with these results and accounted for them by careful tuning with honeycomb coils. When other users of honeycomb coils asked me why they did not get the same results, I would always tell them to wait and keep their coils until they really knew them and knew how to tune with them. Take your honeycomb coils out of the closet and give them a fair chance to prove their worth.

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No. UC-1635 Radio Corp. 1 MF. 1750 volts	2.00

C.W. INDUCTANCES

No. UL-1008 Radio Corp.	11.00
No. P-1 Acme	8.00

C.W. POWER TRANSFORMERS

No. UP-1638 Radio Corp. 325 watts	25.00
No. UP-1016 Radio Corp. 750 watts	38.50
Acme 200 watt 350-550 volts, Mtd.	20.00
Acme 200 watt 350-550 volts, unmtd.	16.00

FILTER REACTORS

No. UP-1626 160 Milliamperes	11.50
No. UP-1627 300 Milliamperes	15.75

GRID LEAKS (Radio Corporation)

No. UP-1719 for 5 watt tubes	1.10
No. UP-1718 for 50 watt tubes	1.65
No. UP-516 ½, 1, 1.5, 2 or 3 megohms each complete with mounting	1.25
Grid leaks only, each	.75

HOT WIRE METERS

No. P-1 Roller-Smith 0-2.5 amperes, flush mtg. Special value at	4.75
No. UM-530 Radio Corp. 0-2.5 amperes	6.00
No. UM-533 Radio Corp. 0-5 amperes	6.25

JACKS (Radio Type)

No. 61 Pacent open jack	.70
No. 62 Pacent closed jack	.85
No. 63 Pacent 2 circuit	1.00
No. 65 Pacent three spring automatic filament control type	1.20
No. 66 Pacent five spring A. F. C.	1.50

LOUD SPEAKERS

No. R-3 Radio Magnavox, new type horn, very latest model	45.00
No. P-1 Vocaloud, station type	30.00
No. 400-W Federal Pleiophone	14.00

MAGNETIC MODULATORS

No. UT-1643 ½ to 1½ amperes	9.50
No. UT-1357 1½ to 3½ amperes	12.50
No. UT-1367 3½ to 5 amperes	17.00

RECEIVING SETS (Crystal)

"Aeriola Jr." Westinghouse, complete with Brandes "Superior" phones	25.00
"Radiola" De Forest, complete with Brandes "Superior" phones	25.00
Radio Service Type S-8 without phones, splendid value	7.50

RECTIFYING DEVICES

No. UV-216 Radio Corp. "Kenotron" 20 watt type for UV-202 tubes	7.50
No. UV-217 Radio Corp. "Kenotron" 150 watt type for UV-203 tubes	26.50
No. P-1 DeForest 20 watt rectifying tube for use with 5 watt tubes	7.00

RECTIFYING DEVICES (for "A" Batteries)

No. P-1 Tungar, 5 ampere type, complete with bulb	28.00
No. P-2 Tungar, 2 ampere type with bulb	18.00
No. P-3 FF Battery Booster, 5 amp. type	15.00

REGENERATIVE RECEIVERS

No. CR-3 Grebe "Relay-Special" 175-680 meters	65.00
No. CR-5 Grebe 175-3000 meters, "Superspecial" complete set	80.00
No. CR-8 Grebe 175-1000 meters, complete set, latest "Relay Special"	80.00
No. CR-9 Grebe 175-3000 meters, complete set with det. and 2 stage amplifier, self contained, "A Masterpiece"	130.00
No. RA Westinghouse, 180-700 meters, very selective, mahogany cabinet	65.00
No. RC Westinghouse, RA receiver and DA Det. Amplifier combined in one cabinet, a splendid unit, compact	125.00

TELEPHONES

No. 56 Murdock 2000 ohm double	5.00
No. 56 Murdock 3000 ohm double	6.00
No. CW-834 Western Electric 2200 ohms	15.00
Brandes, "Superior" with new headband	8.00
Brandes "Trans-Atlantics" with new headband	12.00
Brandes "Navy Type" with new headband	14.00
Baldwins Type C	12.00
Baldwins Type E	13.00
Baldwins Type F	14.00
Baldwins Type C unit only	6.00
Federal A. and N. Type 2200 ohms	8.00
Federal A. and N. Type 3200 ohms	10.50

VACUUM TUBES

No. UV-200 Radiotron detector	5.00
No. UV-201 Radiotron amplifier	6.50
No. UV-202 Radiotron 5 watt	8.00
No. UV-203 Radiotron 50 watt	30.00
No. UV-204 Radiotron 250 watt	110.00

Note:—All Radiotrons sent postage and insurance prepaid anywhere in U. S. A. Send us your orders for Radiotrons.

"Let 'PITTSCO' products, super-service and delivery solve your Holiday problems"

SEND US YOUR ORDERS TODAY!

Send ten cents for Catalog No. 22. Over 100 pages, over 150 illustrations, over 600 items

F. D. PITTS CO., Inc.

12 Park Square, Boston, Mass. *Branch,* Woolworth Bldg., 193 Westminster St., Providence, R. I.

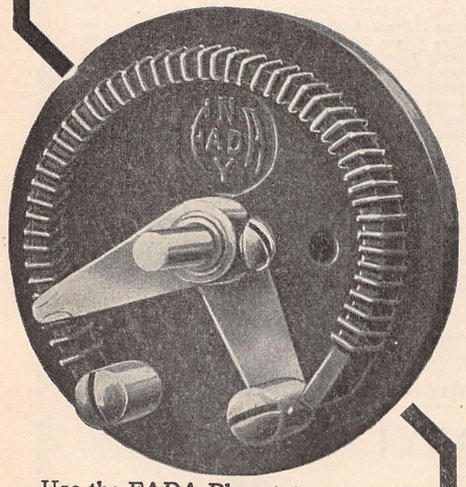
FADA

talks about
FADA *equipment*

Buy FADA Power Tube Rheostats instead of the other kind—you'll save sixty-five cents on every-one—besides being satisfied that the FADA rheo. will do the trick.

No other Power Tube Rheostat obtainable is made with a Thermoplax base and knob and consequently heat resisting. No other rheostat having a resistance of 1½ ohms and a current carrying capacity of 5 amperes is so small in size (2⅛" diameter). And no other rheostat but a FADA costs as little as

$1.35



Use the FADA Rheostat on your Radiophone set. It will keep two Radiotron 5 watt tubes working at their very best.

F. A. D. ANDREA
Manufacturer of FADA Radio Products
1882-A Jerome Ave. N. Y. C.

Grand Opera Broadcasting

(*Continued from page 692*)

locally that broadcasting operas has "arrived" and that wireless is a prime factor soon to be developed beyond the wildest dreams of the everyday optimist, a social and economic factor with nothing short of immeasurable limitations.

No longer will the lucky parents of amateur radio fans be required to dress up in evening togs for the opera and no longer will their "canned opera" consist solely of phonographic selections. This latter recourse was hitherto the only method for hearing opera on the plains of Iowa or the hills of Minnesota. All that is necessary now is to get a radio telephone outfit, become an enthusiast and tune to the wave length of 360 meters to enjoy grand opera for the amplifiers in the auditorium and the Westinghouse Station "KYW" will be in operation all season. The aerial consists of four wires equally spaced, with a 20' spacing employing a counterpoise identical with the aerial dropped about 20' below it. The transmitting equipment is practically identical with that described in the December issue of the RADIO NEWS under "Radiophone Broadcasting, Station WJZ," the oscillator and modulating tubes running on 2000 volts D.C. obtained from a two-phase, 60 cycle h.p. motor, driving a single commutator generator. The filament in the tubes is lighted by 10 volts, alternating current. The equipment has about 500-watt power going into the aerial circuit.

Already two of the largest department stores in Chicago have installed instruments for the purpose of bringing grand opera matinee music to the crowds of shoppers.

News service facilities are soon to be developed at Chicago similar to those in practice at the Westinghouse Station "WBZ" at Springfield, Mass., "WJZ" at Newark, N. J., and "KDKA" at East Pittsburgh, Penna.

The Most Common Story

By Gordon Thomas

If you settle back contented while you're getting P.O.Z.
And you've tuned him in so clearly and from static you are free,
Then just as sure as anything that "ham" from down the street
Will break up your little message clear with his Ford Coil music sweet.
He just rips and tears and blazes and signs up with only "me,"
Then it's time for you old veterans to start hammering on your key
And you rattle out full power with a spark that's swell to see,
Mr. "Ham," I'm very sorry, but I'll just say Q.R.T.

IMMEDIATE DELIVERY

6 N.P. Contact Points....30c
2 N.P. Stops 10c
1 Switch Arm, 1½".....75c
} Special 95c

BRASS RODS, POLISHED and DRILLED

3/32x 7...15c	¼x 7...20c	
3/32x 9...15c	¼x 9...20c	SLIDERS
3/32x13...20c	¼x13...25c	3/32....25c
3/32x16...25c	¼x16...30c	¼....30c
3/32x18...25c	¼x18...30c	

Your set hooked up to your Victrola by our special attachment with Baldy phone and Plug, $12.00. *Complete attachment without phone* $2.50.

MAGNET WIRE

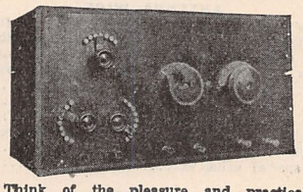
B.&S. Ga.	Price per ½ lb. Spool Enameled	Double Cotton	¼ lb. Spool Double Silk
No. 20	$0.65	$0.80	$0.50
No. 22	.70	.90	.55
No. 24	.75	1.00	.65
No. 26	.80	1.10	.75
No. 28	.85	1.20	.85
No. 30	.90	1.30	.95

Prices net parcel post prepaid anywhere in U. S. Send for our catalog FREE.

24 Hour Service

THE KING RADIO CO.
Century Bldg., PITTSBURGH, PA.

BUILD YOUR OWN WIRELESS RECEIVING SET



You can SAVE at least $25.00 By buying parts and assembling yourself

Think of the pleasure and practical experience you will gain in making your own set, with wave-length range from 170 to 2,500 meters.
We furnish full-sized blueprint and complete detailed instructions for making this set and prices of parts for $1.00.
Write today and get started
K. & G. WIRELESS SUPPLY CO.
Dept. 15A, 152 Chambers Street, New York City

Post-Paid Anywhere

Radio Supplies

of Standard Makes

CHAS. G. ROSEWALL
93 Flatbush Ave.
Brooklyn, N. Y.

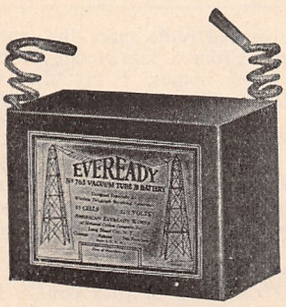
SAVE BATTERY DOLLARS

"A" 6 Volt Storage Battery with Cunningham Tube C 300

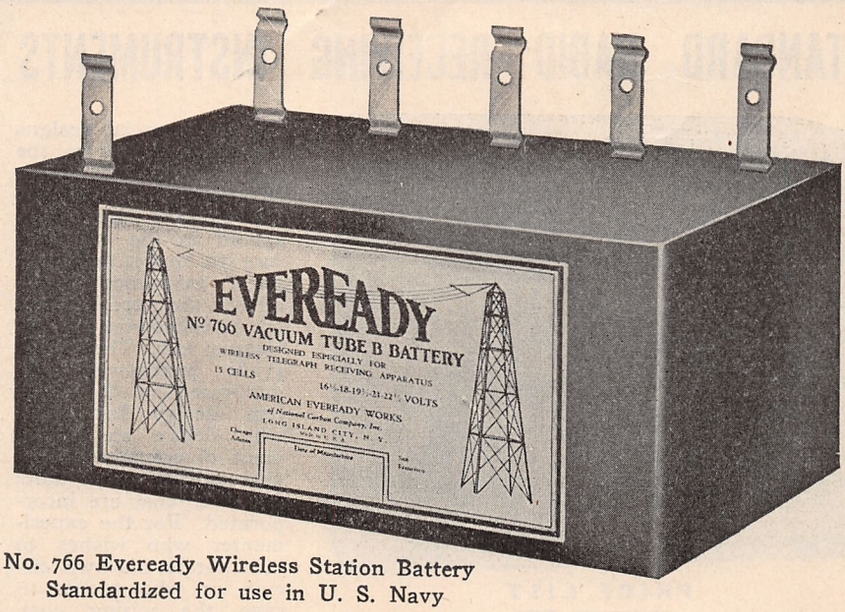
Amps.	Battery only	With C 300 Tube
40	$9.90	$14.50
60	12.65	17.15
80	13.95	18.45
100	17.50	22.00
120	19.95	24.45

Satisfaction guaranteed or money back.
Sent by express collect. Tube only prepaid $5.00.
If Tube C301 is wanted in place of C300, add $1.50

JACKSON BATTERY CO.
1124 JACKSON BLVD. CHICAGO ILL.



No. 763 Eveready Airplane Wireless Battery. Standardized for use in U. S. Signal Corps Aviation Section



No. 766 Eveready Wireless Station Battery
Standardized for use in U. S. Navy

5 SIGNAL FACTS about the Eveready Wireless B Battery

—it lasts longer

Because uniformly high grade materials and refinement of manufacturing processes insure proper working of elements

—its insulation is perfect

Because each cell is coated with special insulating material, and then further insulated from other cells by means of specially treated waterproof cardboard separators

—its operation is noiseless

Because of adequate depolarization and steady voltage, perfect connections, and prevention of corrosive punctures and leaks

—it maintains high voltage

Because ingredients are of proper proportion, and because short circuiting is prevented

—it gives five positive leads without extra cost

Giving critical voltage adjustment for all types of vacuum tubes

This 100% Eveready B Battery, linked to your receiving set, will give you more in service—more in satisfaction—than any battery you have hitherto known.—See your radio equipment dealer—or write us.

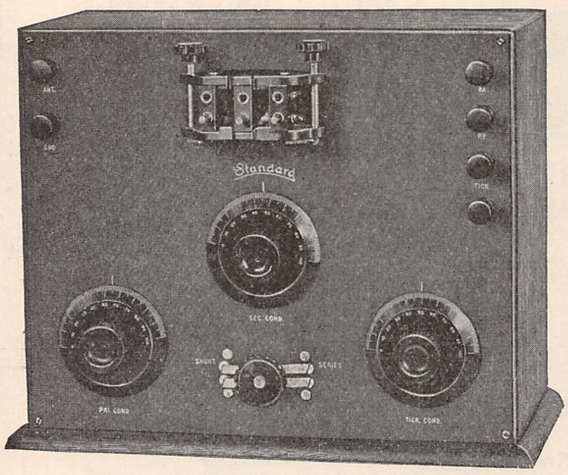
AMERICAN EVEREADY WORKS
of National Carbon Company, Inc.
226 Thompson Ave., Long Island City, New York
Chicago Atlanta San Francisco

EVEREADY
FLASHLIGHTS AND BATTERIES

Note:—Every wireless operator has use for an Eveready Flashlight

N1654

STANDARD RADIO RECEIVING INSTRUMENTS



The Commercial designs are assembled from the most costly and most efficient units available, no expense has been spared in the manufacture to make these the finest instruments ever offered the experimenter, the price however is extremely low. These high grade instruments are duplicated in the amateur design for those who desire an instrument of commercial appearance in which units of lower cost are incorporated. For the experimenter who wishes to incorporate his own circuit, or who wishes to save the wiring cost, both designs are offered in the Experimenter type, completely assembled but unwired. Those who have sockets and other materials on hand can purchase the "KD" type instruments and secure from us the necessary units they lack ready drilled, tapped and ready to fit drillings in STANDARD "KD" panels.

PRICE LIST

COMMERCIAL TYPE

Detector	$17.50	Amplifier	$25.00
Detector-Amplifier	45.00	2 Stage Amplifier	48.00
Detector and 2 Stage Amplifier			65.00

AMATEUR TYPE

Detector	$15.00	Amplifier	$21.00
Detector-Amplifier	40.00	2 Stage Amplifier	42.00
Detector and 2 Stage Amplifier			57.00

EXPERIMENTER TYPE

Detector	$15.00	Amplifier	$22.00
Detector Amplifier	37.00	2 Stage Amplifier	40.00
Detector and 2 Stage Commercial Amplifier			55.00
Multiple Wave Tuner, 160 to 25,000 meters			45.00
150-600 meter Regenerative tuner			47.00
Short wave tuner with tube control			57.00

"KD" TYPE

Tube control	$13.00	Amplifier	$13.00
Multiple wave tuner	14.50	Regenerative tuner	12.50
Regenerator and Control	14.50	2 Stage Amplifier	16.00
Detector and 2 Stage	19.00	Detector and 1 Stage	16.00

Any STANDARD instrument will be shipped anywhere, allowing examination, on receipt of a deposit of 1-3 the list price. Examine it carefully, if not entirely satisfactory return it and we will refund deposit.

We can make immediate shipment on any prominent make of instrument or small parts. We pay the postage and ship the day order arrives. Try our service. Mail deliveries at our address are made hourly.

STANDARD ASSEMBLING COMPANY

19 BRIDGE STREET, NEW YORK

SPECIALS

6 Volt 80 Amp, hour Storage Battery, for "A" Battery... **$12.00**

Thordarson Amplifying Trans. **$4.00**

Knocked-Down Short Wave Set **$10.00**

DAVID KILLOCH CO., 57 MURRAY ST. NEW YORK CITY

All Wizard Batteries are absolutely guaranteed

FROM MANUFACTURER TO USER

ALL BATTERIES SENT POSTPAID

Buy direct from the manufacturer and receive a Fresh Battery

Announcing Wizard's 2 New Improved Type "B" Batteries

No. 1632—1 tap 45 Volt Var. Battery, Size 6x5x2⅜ in. (Wt. 3¾ lbs.) Price $2.80
No. 1630—6 tap 27 Volt Var. Battery, Size 6x3x2⅜ in. (Wt. 2½ lbs.) Price $1.80

These new types are not made of the same size cells as a small size "B" Battery. The volume of one of the cells in these types is 4.7 cu. inches as compared with 2.5 cu. inches, the volume of a cell used in small "B's". You can easily see that the life of these two types are almost double the life of the small "B's."

OTHER WIZARD TYPES

Cat. No.	Size	Taps	Voltage	Weight	Price
1623 Plain	2½x2x3⅝		22½	1 lb.	$1.00
1623 Variable	2½x2x3⅝	5	22½	1 lb.	1.20
1625 Plain	3 x4x6⅝		22½	5 lbs.	1.85
1625 Variable	3x4x6⅝	5	22½	5 lbs.	$2.25
1626 Plain	3x8x6⅝		45	10 lbs.	3.75
1626 Variable	3x8x6⅝	6	45	10 lbs.	4.15

Send all money orders to Write for Bulletin No. 6

WIZARD BATTERY CO. *Dept. R* **1315 42d St., Brooklyn, N.**

Keeping the Boys at Work

(*Continued from page 710*)

To the advanced radio man this seems a foolish item. From a knowledge of more than 4,000 boys' homes, I say that it is worth printing. The boys are inspired because they are taken seriously instead of being treated like kids. They will never forget the man who talked with them, wrote them up and sent them to the newspaper office with the item, and the nautical term "standing watch" makes them feel like admirals.

Other boys will say: "I did better than that," or, "I can do it if they can." They come with their reports and inquiries.

GIVE THE NEWSPAPERS A CHANCE TO HELP

Soon there are inquiries enough to justify calling in a reporter—a radio bug preferably—and suggesting a radio department in the paper. Just a little "dope" daily, and a few answers to typical questions. Local editors welcome such stuff. It is a circulation builder.

At the end of the week's test the reports come in. Of course every juvenile operator expects a report by radio the same night. It reads like this:

QST Smith and Proctor announce that owing to the large number of reports received from operators, a committee is needed to go over them and report on eligibility of operators for Emergency Radio Corps. Following are asked to serve: Mr. Scribbler, radio editor of the *Gazette*, and (insert one older boy from each section of the city).

Unless replies are received early the next day, the appointees are followed up by phone, mail or messenger. They meet that night and find their task doubly agreeable. Firstly, they have the fun of admitting successful operators as members of the corps; secondly, they have the very great pleasure of keeping others out until they qualify. From now on all the scheme needs is careful steering. The details can be turned over to volunteers.

THEY WANT RADIO, NOT PARLIAMENTARY PROCEDURE

At this stage of the game, the organizer must steer around the rock on which many boys' organizations founder. Somebody proposes an organization meeting. Either put it off, or suggest that those who are specially interested in parliamentary stunts form a club by themselves without trying to make a big organization. Constitutions, by-laws, business meetings, have their places, but they are forced upon many a budding group that would get along better without them.

If an organization meeting is held, have all the problems thrashed out in advance by the enthusiasts and strictly limit the business end of the meeting to fifteen minutes. Let the rest of it be all radio and give every boy present something to do.

This is not as hard as it sounds. A receiver and loud speaker on the platform can be made to bring in from somewhere a slow message that can be used as the basis for a code contest. Let the juvenile ops know in advance that paper and pencil will be needed, or have these things ready for distribution. Each boy copies the message as well as he can, signs his name and address and hands in his paper. These papers are given to a committee which rates them all according to the correctness of the reception. The list is published in the papers. Sometimes it may be well to spare the feelings of the backward ones by publishing only the names of boys who have a grade of 75 per cent. or over, but usually it is better to print them all. This leads to the stimulation of slow ones by the razzing they get from the others.

The Newman-Stern Co.

CLEVELAND OHIO

MAIL ORDER RADIO SERVICE

IMMEDIATE DELIVERY-TRANSPORTATION PAID

In these days, when dozens of new radio "companies" spring up over night and fade away almost as quickly, it is important that you place your confidence in proven and reliable sources of supply.

As pioneers in the radio field—as one of its oldest manufacturers and distributors—we have watched its meteoric growth and have learned much from watching.

We *know* the radio game and we *know* the mail order business. We realize to the fullest extent the type of service this business demands—*and we render this type of service.*

If you could see for yourself the large and varied stocks which we constantly carry—if you could watch for a time the manner in which we conduct our business—you, too, would be numbered among our thousands of friends and customers the world over.

Send Now for *FREE* Radio Catalogue

The Newman-Stern Co.'s Radio Catalogue, Edition E-6, is a reliable listing of reliable goods—eighty pages solely devoted to wireless apparatus and supplies. In addition to listing our own products, this book illustrates and describes accurately the products of the foremost radio manufacturers of the country. Every radio enthusiast should have this book.

We are authorized Factory Distributors of such lines as

Radio Corporation	DeForest	Burgess
Westinghouse	Amrad	Hipwell
Cunningham	Kennedy	Bunnell
Murdock	Grebe	Jewell
Remler	Tuska	Firth
Signal	Acme	Connecticut
Chelsea	General Radio	—and 47 other
Federal	Thordarson	well known products

ANY OF THESE ITEMS AND HUNDREDS OF OTHERS LISTED IN OUR CATALOGUE E-6, WILL BE SENT TO YOU PROMPTLY UPON RECEIPT OF PRICE.

ALL TRANSPORTATION CHARGES PAID

VACUUM TUBES

Radiotron Detector Tube	$5.00
Radiotron Amplifier Tube	6.50
Radiotron 5 Watt Transmitter	8.00

TELEPHONE RECEIVERS

Murdock No. 55 Receivers	4.50
Murdock No. 56 Receivers	5.00
Baldwin Type "C" Receivers	12.00
Brown Type "D" Receivers	16.00
Red-Head 3,000 Ohm Receivers	8.00

PANEL TYPE VARIABLE CONDENSERS

Murdock .001 Mfd.	4.00
Murdock .0005 Mfd.	3.25
Chelsea .0011 Mfd.	4.35
Chelsea .0006 Mfd.	3.85
Signal .001 Mfd.	4.70
Signal .0005 Mfd.	3.90

CRYSTAL DETECTORS

DeForest Crystal Detector	2.60
Murdock Crystal Detector	0.70
Jove Crystal Detector	1.70
Westinghouse Crystal Detector	6.00
Murdock Loose Coupler	9.00
Signal "Navy" Loose Coupler	19.50
Murdock Variometer (complete)	7.50
Remler Variometer (less dial)	6.00
Murdock Variocoupler (complete)	8.50
Remler Variocoupler (less dial)	5.40

AERIOLA JR., The Westinghouse complete crystal Receiving Set with 'phones and portable cabinet $25.00

Paragon V.T. Control	$6.00
Remler V.T. Control	8.00
Hipwell "B" Battery	3.00
Burgess "B" Battery	3.00
Hipwell Small "B" Battery	2.00

AMPLIFYING TRANSFORMERS

Acme Amp. Transformer	5.00
Chelsea Amp. Transformer	4.50
Rhamstine Amp. Transformer	3.50
Saco-Clad Amp. Transformer	5.00
Radio Corporation Amp. Transformer	7.00
Radio Corporation H. W. Meter	6.00

WESTINGHOUSE INSTRUMENTS

Type RA Tuner only	$68.00
Type DA Detector & 2 Stage	68.00
Type RC complete Receiver	130.00
Kennedy Short Wave Receiver	80.00
Kennedy Medium Wave Receiver	125.00
Kennedy Universal Receiver	250.00
Signal Short Wave Receiver	37.50

DE FOREST INTERPANELS

Detector Panel	13.50
Amplifying Panel	17.75
Tuner Panel	43.00
Transmitter	100.00
Firth Vocaloud Loud Speaker	30.00
Magnavox Loud Speaker	45.00
Vocarola Loud Speaker	30.00

THE NEWMAN-STERN CO.

Newman-Stern Building **Cleveland, Ohio**

Supersensitiveness!

That's what you can expect of

N. A. A.

(Arlington Tested)

DETECTOR CRYSTALS

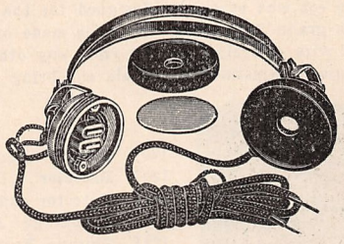
Each crystal is carefully and individually tested, wrapped in foil and packed in a convenient lithographed metal container.

For sale by live dealers and jobbers everywhere—or shipped prepaid on receipt of price.

N. A. A. Galena	25c
N. A. A. Silicon	25c
N. A. A. Goldite	25c
N. A. A. Galena (Mounted in cup)	40c
N. A. A. Silicon (Mounted in cup)	40c
N. A. A. Goldite (Mounted in cup)	40c

CAUTION!—N A. A. crystals are the original Tested Detector Minerals. You can distinguish the genuine by the signature of J. S. Newman, lithographed on each package.

"RED-HEADS"



A Triumph in Radio Receiver Design

3000 Ohms $8.00 Pair Prepaid

Here's real value in wireless 'phones

Beauty of design and ruggedness of construction coupled with a supreme sensitiveness are features that make "Red-Heads" the ideal telephone receivers for wireless work. "Red-Heads" cost less per unit of sensitiveness and quality than any other receivers on the market.

OUR GUARANTEE shows the faith we place in their performance. Your money cheerfully refunded if they do not come up to your highest expectations.

DEALERS!

Cash in on the big demand for the famous N. A. A. Detector Crystals and "Red-Head" Receivers. See your nearest jobber for details, or write for attractive dealers' proposition.

A BIG HIT 5% DISCOUNT

Still Going Good Mr. Radioman!

Our special offers in previous issues of "Radio News" made such a hit that we decided to continue them this month. We will allow you either a 5% discount or your choice of a tested grid or phone condenser on any order amounting to $2.00 or over. Thousands will take advantage of our offer. Why not be one of them OM?

5% DISCOUNT

Buy All of Your Radio Supply Needs From Us and Save Money

PUT YOUR MONEY TO GOOD ADVANTAGE. ORDER DIRECT FROM THIS AD. SAVE TIME AND MONEY.

PROMPT AND RELIABLE MAIL ORDER "SERVICE." REMEMBER WE PAY THE SHIPPING CHARGES, TO ANY POINT IN U. S. A., WHICH IS A BIG ITEM IN ITSELF.

Make Your Selection of Radio Equipment from the Following Specials

AMPLIFYING TRANSFORMERS

Acme	$5.00
Rhamstine	3.50

BATTERIES

Ace "B" No. 623 Plain, no taps, 22½ volts	1.25
Ace "B" No. 623 Variable, 5 taps, 22½ volts	1.50
Ace "B" No. 627 Variable, 16 taps, 45 volts	3.25
Gould, 6 volt, 60 ampere filament storage battery	15.75

BINDING POSTS

Nickel plated pillar, hard rubber top	.09

CRYSTAL DETECTORS

Murdock	.70
DeForest Signal Corps type (enclosed)	2.50

CONDENSERS

Grid Condenser .0005 mfd.	.35
Grid Condenser with leak	.50
Phone Condenser .001 mfd.	.35
Chelsea Variable, with knob and dial for panel mounting, .0011 mfd.	4.75
Chelsea Variable, with knob and dial for panel mounting, .0006 mfd.	4.25
1 mfd. tested to 1,000 volts (for C.W.)	2.00

DIALS

Chelsea, 3¼ in. bakelite and knob for ¼ in. or 3-16 in. shaft	1.00

JACKS AND PLUGS

Rhamstine, jack only	.75
Rhamstine, plug only	.75

LOUD SPEAKERS

Magnavox, latest type	43.00

PHONES

Murdock, No. 56, 2000 ohms, double	5.00
Murdock, No. 56 3000 ohm, double	6.00
Baldwin Type, "C" Mica Diaphragm, double	12.00

RECEIVING TRANSFORMERS

Murdock, 150-1000 meter, loose-coupler	9.00
Murdock, 2 slide tuning coil	4.00

RHEOSTATS

Murdock, new type for panel mounting	1.00
Fada, new type knob, reduced to	1.00

SOCKETS

Murdock, moulded type	1.00
Radio Corporation, for UV-200, UV-201, UV-202 and UV-216 tubes	1.00
Ace, with grid leak mounted on base	1.50
Crosley, entirely porcelain	.60

SWITCH POINTS

Nickel Plated ¼x¼ in., with screw, each	.35
Nickel Plated ⅛x¼ in., with nut, each	.35
Nickel Plated 3-16x3-16 in. with screw, per doz.	.35
Switch Stops, nickel plated, ⅜ in. high, each	.06

SWITCHES (ROTARY PANEL)

Nickel Plated 1¼ in. lever, bakelite knob	.50

VARIOMETERS AND VARIOCOUPLERS

Variometer type MW-6, 500 meters	5.00
Variocoupler type MW-7, 500 meters	4.00

VACUUM TUBES

Radiotron UV-200 Detector	5.00
Radiotron UV-201 Amplifier and Detector	6.50
Radiotron UV-202 5 watt transmitter	8.00

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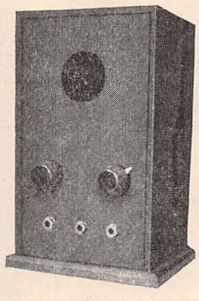
MIDWEST RADIO COMPANY

3423 DURY AVE. Dept. A CINCINNATI, OHIO

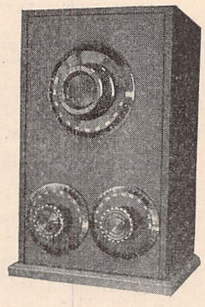
BULLETIN FREE

Wireless Telephone Broadcasting Receiver

This set was especially designed for the private home, Stock Brokers' Office, Banks and high grade Radio stations. It is made of the highest type of radio receiving instruments and wire entirely different from any other receiver, which enables you to get the most accurate adjustments possible and bring in the voice very loud and clear.



		Price
1208	Tuner	$35.00
1209	Detector	7.00
1211	Detector and One-stage Amplifier	25.00
1212	Two-Stage Amplifier	29.00
1213	Storage Battery 6,100 Amps	18.00
1214	Complete Four-Wire Aerial	8.50



Sidbenel Radio Mfg. Co.

2415 Creston Avenue Bronx, New York City

STOP! LOOK! and ACT!

We supply free of charge with each 50 watt U.V. 203 power tube, price $30.00, the R.C. of A. porcelain V.T. Socket, price $2.50; and with each 5 watt U.V. 202 power tube, price $8, your choice of either a Fada 5 ampere Nichrome power rheostat or R. C. of A. porcelain V.T. Socket. Unsatisfactory Radiotron Tubes will be replaced at once. No risk. Shipped post paid and insured. Immediate delivery. Distributors for Acme, R. C. of A. and Federal C.W. Apparatus.

THE KEHLER RADIO LABORATORIES, Dept. R, ABILENE, KANSAS

A welcome addition to your library! Send $2.50 today, plus postage for 7 lbs., and your copy of bound volume No. 2 of Radio News will come forward by return mail.
Experimenter Publishing Company, Inc. 236a Fulton Street, New York City

The average boy would rather be mentioned than left out, regardless of his standing. In other subjects it might hurt his feelings to be mentioned as an "also ran," but in radio even the catching of five letters out of a hundred will make a beginner feel that he is making progress, and the next time he will try to do better.

If code seems hard for the boys to learn, some Boy Scout man can be secured to talk on "Rememberable Morse."

SHOW THEM HOW A "BIG SET" WORKS

Another feature of such a gathering could be a demonstration of up-to-date apparatus. Such a demonstration would mean sales, then or later. If the attendance were small, and there were time enough to let each boy sit down before a regenerative receiver and bring in some station by setting the switches and dials as indicated on a card that the leader gave him, a lasting impression would be made on every beginner. This could be clinched by putting the leader's "OK" on the card together with his signature or initials. It seems childish, from the standpoint of mature men, but what one of us has not, in some treasure chest back home, mementoes of far less real value that we have kept and thrilled over at intervals for twenty, thirty or forty years? It may be our first Exhibitor's Pass for the county fair where we exhibited a pet owl, or a wooden foot-rule given by the man who explained the workings of a gas stove. The memory of first experiences never dies and the things we do today can all be traced back to them.

If one or two big meetings go well, it is time to break the corps into neighborhood units. A pair of older boys can be delegated to give in public schools demonstrations similar to those given in the larger gatherings. The dealer can go with them, or not, as his judgment dictates. Every such demonstration will bring a flock of new beginners if the way is made easy, and these can be combined with those already started to make a local branch of the Radio Emergency Corps.

OLDER BOYS WILL HELP YOUNGER ONES

The first time a dealer is in a position to trust two reliable boys with an outfit to take out all by themselves for a demonstration, or with a loud speaker, or some other accessory to supplement their own outfits, he establishes a connection that is highly valuable. Boys like to be trusted and when they are trusted, they usually measure up to the responsibilities that they assume. They need to be followed up and checked up closely so that mistakes may be corrected and their good work commended. Practically all reports of the untrustworthiness of boys that I have ever heard have been accounted for by the fact that the adult who gave them something to do did not check them up closely enough or in the right way. They must be held strictly accountable for whatever of intrinsic value has been placed in their hands and for the completion of any task they undertake. Boys do not appreciate values as men do because they have not had to pay for things as men have. They must be impressed with the fact that apparatus costs money and can and should be handled without damage, and that failure hurts, not only themselves, but also many others. At the same time there must be good humor in all criticisms.

A fact seldom appreciated by men is that boys in their teens care more for recognition than for cash. A boy will work his head off just for the sake of feeling that he is recognized as part of a concern and can talk with the boss and be given things to do that the common herd are not yet ready for, such as going to another boy's home and showing him how to get results from his apparatus. Begin to pay him at that stage and you ruin his helpful spirit. Even after I had worked for many years

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"The Electrical Magazine for Everybody"

PRACTICAL ELECTRICS is probably the most novel magazine of its kind ever conceived. It is personally edited by H. Gernsback, editor of SCIENCE & INVENTION and RADIO NEWS. Mr. Gernsback, who founded the old MODERN ELECTRICS as well as the ELECTRICAL EXPERIMENTER, knows thoroughly what the public wants and has wanted for many years. In presenting this new magazine he but heeds the thousands of letters received by him to establish a new 100% electrical magazine that will beat the best that was in MODERN ELECTRICS and ELECTRICAL EXPERIMENTER.

Electricity covers such a tremendous field that the man who does not keep abreast with it does himself a great injustice. PRACTICAL ELECTRICS covers that field from every angle. It is written in plain every-day language that all can understand. It portrays the entire electrical development of the month faithfully in non-technical language. It caters to everyone interested in electricity, be he a layman, an experimenter, an electrician or an engineer—each will find in this magazine a department for himself and plenty more.

The January issue now on the news-stands contains 48 pages and over 100 different articles and close to 100 illustrations, with an artistic cover in two colors. Professor T. O'Conor Sloane, Ph.D., is associate editor of the magazine.

This issue also contains articles by some of the greatest living electrical writers, workers and students and the magazine will prove a revelation to any one interested in electricity.

PRIZES

This magazine offers a number of prizes, as follows:
$100.00 Household Wrinkle Contest.
$3.00 for the best picture of your electrical workshop.
$3.00 for the best article on Elec-Tricks, the new department.
$3.00 for the best "short-circuit," the semi-humorous department.
In addition to this, the magazine pays high prices for all electrical experiments, electrical articles, etc.
See Current Issue for Full Details.

Inasmuch as the new magazine has a circulation of only 25,000 copies, we urge you to place your monthly standing order with your newsdealer at once. Or if you wish, fill out the coupon below for your subscription and take advantage of our special offer.

Every issue besides its many other features contains the following departments:

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"Electrical Digest"
"Junior Electrician"
"My Laboratory"
"Elec-Tricks"
"Motor Electrics"
"Short Circuits"
"How and Why" (Questions and Answers.)

Make all checks payable to: Practical Electrics Co."

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Gentlemen:

Although your regular price is $2.00 per year, you will accept my subscription at $1.75 per year (Canada and foreign $2.25) and enroll my name as a charter subscriber. I enclose the money herewith and I have written my name and address in margin below.

THIS OFFER VOID AFTER FEBRUARY 28th

R.N. 2-22

RESULTS

DX RADIO FREQUENCY AMPLIFYING TRANSFORMERS

WILL Bring in that LONG DISTANCE RADIO CONCERT

ON COIL AERIAL

All U. S. Amateur
RECEIVING RECORDS BROKEN
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DX-1 Radio Frequency Amplifying Transformers
Simple Amplifier Construction

Sheet of Circuit Diagrams 25c

Send Stamp for Bulletin No. 10E

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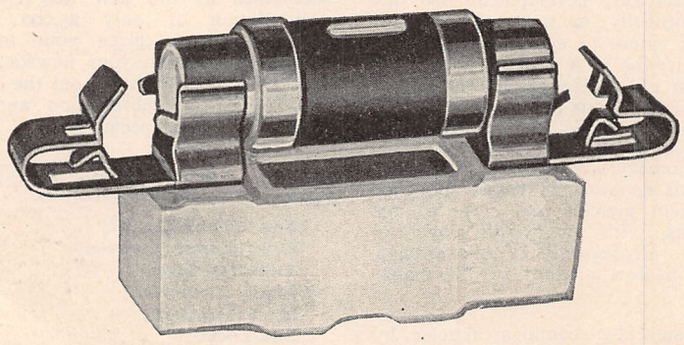
BRACH RADIO PROTECTORS

For Radio Telegraph and Radio Telephone Receiving Stations



The National Electric Code Permits the use of Vacuum Tube Protectors in place of the Grounding Switch Formerly Required.

The Brach Radio Protector Tube Meets the Requirements.

Where Radio Transmitters are Operated from Public Service Mains, two Brach Radio Protectors connected in series, with midpoint grounded, furnish the least expensive, and the best protection against surges. Price $2.50.

Order early to make sure of obtaining a supply. Patents allowed and pending. Manufacturers of Lightning Arresters, Signal, Telephone and Wireless Specialties.

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211 RADIO MANUFACTURERS and DEALERS are now using our
BINDING POSTS, SWITCH POINTS, ETC.
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CREW MACHINE PRODUCTS *Get Our Literature*

with boys, I made this fatal mistake with half a dozen who were doing so much work for me around my picture show that I was ashamed not to pay them. The first time I gave them half a dollar apiece I saw at once that we were no longer friends working together, but employees and boss. From then on they were very conservative in their use of energy, and much less interested in what they were doing. I might better have satisfied my conscience by rewarding them in other ways, such as getting them a chance to visit a moving picture studio and meet a movie star. Such things they could brag about, but half a dollar was only good to spend.

Older boys, when properly led themselves, make better leaders for younger boys than most adults. They understand the younger boys better and will give more time to the little details. Incidentally they will lead a lot of trade to the dealer who encourages them. I do not believe that any dealer would develop such coöperation merely for the purpose of exploiting boys for his own profit. I do believe, after working both ways myself, that the best philanthropic work done in this country is done by business men in connection with their business, and that they are entitled to whatever profits come from it legitimately. The development of a boys' radio organization is public service.

Field work with portable outfits will give new zest to a radio corps. In work with boys there must always be something new, until habits are solidly formed. By enlisting the interest of teachers, Y. M. C. A. men, Boy Scout leaders and others who know boys, all sorts of games can be arranged in which a radio corps will have a part. Radio chess and checker matches between teams representing different organizations, or different branches of the same organization, can be arranged with no more work on the part of the radio dealer than making the suggestion and possibly loaning and operating a set for an evening. Dealers in different cities can work together in this game.

Radio contests for the boys of a city, county or State can be arranged by dealers without great expense of either time or money if they have a little ability in organizing. The tremendous interest aroused by newspapers in all parts of the country by simple contests of various kinds shows the attraction of this method. Newspapers can easily be interested in coöperating with radio dealers in promoting radio contests.

The following outlines are suggested for such contests. In place of the broadcasts mentioned any other convenient broadcasts may be used as bases for the contests, but receiving messages from a Government station has greater interest for a boy than receiving from a private station, provided the Government traffic is definitely connected with his own activities, as the Radio Amateur Bureau in the Third Naval District connects it. The Amateur Broadcast from NAH could and should be made the basis of a system in every community that would give every boy a chance to do definite and important work for our Government. Every community that listens to this Navy station can be instantly advised of dangers or opportunities that have come to the attention of the authorities in Washington.

HOW TO START WIRELESS CONTESTS FOR BOYS

Arrange with local newspapers to print something like the following:

There are 250,000 wireless "bugs" in the United States. You in this city have hooked up your tuning coils and loose couplers and detectors and condensers in every possible way—and a few impossible ways—and you know the difference between QRM and QRN and everything. But half of you couldn't read your own names if they were coming in so strong that you could hear them 20 ft. from the 'phones.

Why MAGNAVOX equipment is necessary in YOUR set—

THERE is no substitute for the RADIO MAGNAVOX. It is standard equipment, tested and approved by the radio fraternity, and no set now is complete without one. It supplies the means by which music, news, speeches, conversations, signals, etc., received by radio can be reproduced so loud and clear, and true to the original that any number of people may hear them and enjoy them simultaneously, depending on the amount of amplification.

Because the strength of sound depends on the amount of current in the movable coil, and the strength of the magnetic field, the effectiveness and volume of the MAGNAVOX can be greatly increased by hooking up with one of the new MAGNAVOX two or three stage POWER amplifiers. This assures the MAGNAVOX receiving the greatest possible power input because these amplifiers are designed to use transmitting tubes and high plate voltages. They are also designed especially for the amplification of music and speech, eliminating danger of distortion.

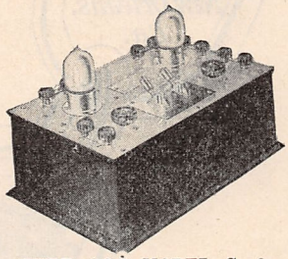
YOU WILL eventually have this equipment. Why postpone such enjoyment? MAGNAVOX equipment is simple and free from complex adjustment. Any one can hook it up and operate it without trouble. Nothing can take its place. See your dealer today and obtain maximum efficiency and results from your set.

THE MAGNAVOX CO.—Factory Office—OAKLAND, CALIFORNIA.
NEW YORK OFFICE—370 Seventh Ave.—PENN. TERMINAL BLDG.
When writing please address the MAGNAVOX Office nearest you

MAGNAVOX

TYPE R-3 (Illustrated) The RADIO MAGNAVOX, the standard loud speaking reproducer for amateur and home use, no set complete without it, has 14" horn and takes only one ampere to energize the field.....**$45**
TYPE R-2 The largest size, with 22" horn and field switch. The highest type of loud speaker obtainable at any price, maximum efficiency obtainable using only one-half ampere in field....**$110**

MAGNAVOX AMPLIFIERS



TYPE AC-3 MODEL C, 3-stage, a new type, designed for transmitting tubes and high plate voltages. Designed for the amplification of radio speech and music without distortion, and will give maximum output to energize your MAGNAVOX, or in fact any type of receiver. Master stage to stage switching, mahogany case, sits flat or on edge, **$110**
AC-2 MODEL C, 2-stage (illustrated), exactly as the 3-stage except two stages, same quality and design throughout **$80**

MAGNAVOX equipment is sold thru dealers. Accept no substitute. Look for this trade mark on each instrument. If your dealer cannot supply you write our nearest office. Send for folder illustrating and describing the Radio MAGNAVOX, the famous movable coil. and other MAGNAVOX equipment complete. Free. Send for it now.

There is no substitute for the Radio MAGNAVOX

Service to Radio Amateu

THE SORSINC TUNIT

This is the sensational new tuning device that duplicates the performance of the most expensive short wave sets at a price any amateur can afford. It consists of a stationary coil and two rotors, mounted in one rugged unit that snaps into your standard triple-coil mounting. Tunit responds on 160 to 600 meters. It gives you a sharpness of tuning and a sensitiveness equalled only in the most expensive short wave sets. Every essential is provided in highest qualty to give you the utmost value per dollar! And the price —only $15! Tunit is now on the market. It is displayed at all Sorsinc branch stores and at most leading radio dealers. Examine Tunit at your first possible opportunity—it is the biggest $15 worth in radio today. Sent by mail prepaid.

$15.

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At every one of the ten Sorsinc branches i
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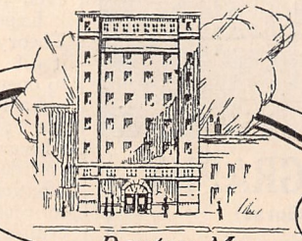
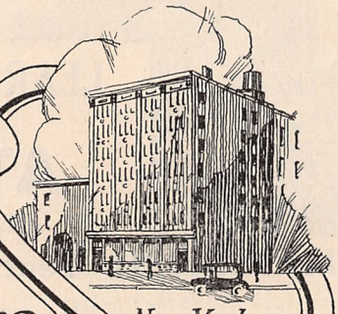


Boston, Mass.



New York

...s by Commercial Operators

are there to give you a unique service—the kind of helpful advice that insures best results from your apparatus.

If you cannot personally visit one of the Sorsinc stores, every branch is equipped to serve you efficiently by mail. Look thru the list below for the Sorsinc branch nearest you, and the name of the man in charge:

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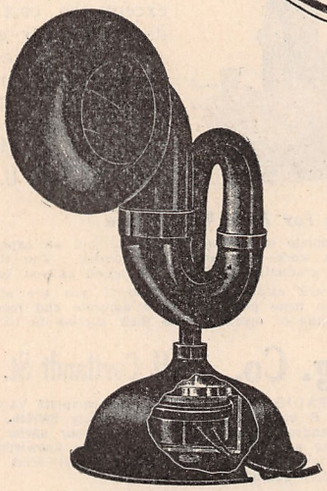
European offices located at
65 Fenchurch St.

Descriptive folders are also ready on the Sorsinc Tunit and the de Forest Every Man Set and will be gladly mailed free to interested parties.

Dealers: Get in touch with us at once about the possibilities of the Sorsinc Tunit—a rapid seller that gives you a liberal profit.

...s for All Leading Radio Makes



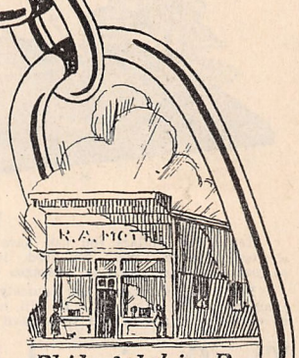
The "Arkay" RADIOHORN

Insert any standard telephone receiver unit, tighten set screw, and you have a completely satisfactory loud speaker—for only $5.00! The "Arkay" Radiohorn was designed by specialists in sound reproduction. It reproduces voice and music, as well as telegraph signals, with a rounded natural tone, fully equal to any loud speaker costing many times the price.

Why bother with a head set any longer? For less than the price of an additional pair of phones you can hear your signals all over the room. A Baldwin type "C" unit is recommended, but you can use one unit from whatever phones you now have.

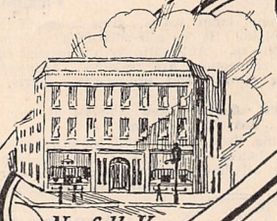
Listen to the Radiohorn at any Sorsinc branch store, or send your order by mail. Black Japanned finish, as shown, $5.00. Nickel plated $6.00.

$5.

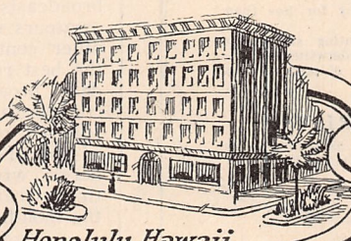


Philadelphia, Pa.

Baltimore, Md.



Norfolk, Va.



Honolulu, Hawaii

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...VICE, INC.
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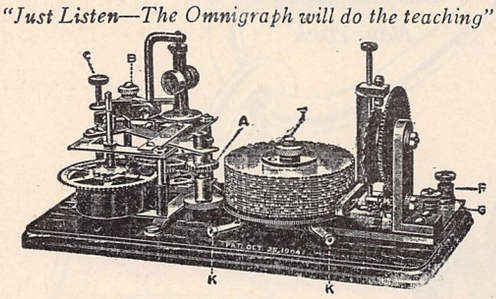
LEARN TELEGRAPHY
(Wireless or Morse)
AT HOME
In Half the Usual Time

Let the OMNIGRAPH Teach You Wireless

"Just Listen—The Omnigraph will do the teaching"



The Omnigraph is an *Automatic* Transmitter that teaches you both the Wireless and Morse Codes, at home, without any expense except the cost of the machine itself. Merely connect to battery and your Buzzer, or Buzzer and Head Phones, or to your Sounder and the Omnigraph will send unlimited messages by the hour, *at any speed* you desire.

USED BY THE U. S. GOVERNMENT

Write for Free Catalogue

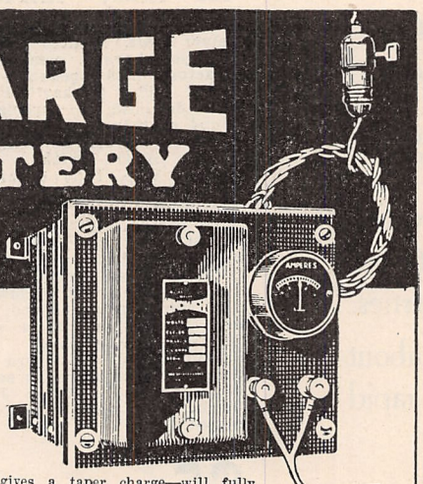
For a few dollars you can have a complete outfit that will make you an experienced operator in the shortest possible time. No hard, laborious work—just learn by listening. The Omnigraph is adjustable so you can start receiving messages slowly, gradually increasing the speed as you become proficient.

You'll be surprised how quickly you will attain speed. Even if you are already an operator the Omnigraph will help you. It will make you more proficient, more accurate and more confident. Thousands of Omnigraphs are in use today and thousands of operators owe their success to them.

The Omnigraph Mfg. Co., 26-H Cortlandt St., New York City

We also manufacture the OMNIGRAPH RADIO RECEIVING SET. A complete Vacuum Tube Set including Tube, a pair of 2,000 ohm Phones, A and B batteries, Aerial Wire, Safety Switch, Insulators and Ground Clamp. All enclosed in a carrying case, handsome enough to install in your parlor or sitting room. Price $48.00. Nothing to approach it at anything near the price. No previous knowledge of wireless required. Set comes to you completely wired. Nothing additional to purchase. Just erect your Aerial, place the Phones to your ears and listen-in. Absolutely guaranteed.

HOMCHARGE YOUR BATTERY for A Nickle



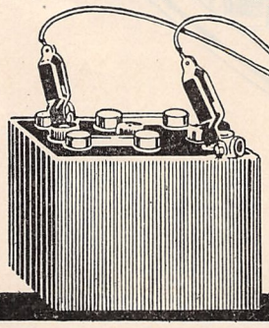
A perfect rectifier at last, fully automatic and foolproof in every respect. It can be operated by anyone.

The HOMCHARGER

Connects to any alternating current lamp socket, gives a taper charge—will fully charge any "A" battery over night. It is self-polarizing. Connect your battery either way and it will always charge. Automatically disconnects battery when power is interrupted. Restarts charging when connections are restored. Adjustable for wave form, frequency and voltage. Contains only one moving and two wearing parts, lasting thousands of hours, replacable as a unit for $1.00.

The highest charging rate, greatest efficiency, and simplest of any rectifier selling for less than $100.00. Bulletin 628 proves it. Ask for your copy.

Manufactured in sizes for charging three or six cell batteries from both alternating and direct current circuits. Cannot injure battery—will last a lifetime—approved by underwriters—satisfaction guaranteed. For sale by all Radio, electrical and accessory dealers or shipped express prepaid for purchase price—$18.50



ATTENTION MOTORISTS:

Send for special bulletin 58 showing how easy it is to "HOMCHARGE" your battery.

THE AUTOMATIC ELECTRICAL DEVICES CO.
118 West Third St. CINCINNATI, OHIO
Canadian Distributors—Rowley & Moody, Ltd., Toronto

Could you, at 20 words or 16 words, or even 10 words per minute?

Experimenting is all right. Keep it up. Theory is essential. Keep on till you know it all. But remember that it is impossible to operate a radio system without operators.

Early in the war our Government started out vigorously to develop radio men. Classes were opened in camps and colleges and celebrated teachers secured. In a few months the graduates of these classes began to receive assignments on battleships and cruisers and destroyers.

They knew radio, you bet! They could follow an electron through the filament, grid and plate of a vacuum tube as easily as they could trace the course of the Mississippi River. They were high grade men physically, mentally and morally, but most of them had one common fault when they went on watch for the first time. They could not copy their own ship's call letters and they didn't know whether she was being called by NAA or the Eiffel Tower or a German submarine. As operators, many of them were useless until they had had a month or six weeks more of code practice.

It was not their fault, nor the fault of our Government, nor the fault of the schools nor the instructors, it was due to the fact that operating cannot be learned in a month or two.

Our Government needs radio operators in peace as well as in war. So do commercial concerns, especially those which own and operate merchant ships. Radio operators—good ones—can travel around the world and be well paid for it. It is worth while to acquire speed even though you use it only for picking up "press" for the folks at home.

You wireless boys have a good start. You know the code and can receive at slow speed at least. All you need is a little practice in handling real traffic and you will develop rapidly into regular operators. So here is the chance we offer you:

CONTEST NUMBER 1

NAH, the New York Naval Radio Station, broadcasts an amateur schedule daily at 9:30 P. M. on 1,832 meters, spark. For the best records proving the reception of these messages by an amateur during the month of ..... we will give:

First prize .....
Second prize .....
Third prize .....
(Add more if desirable.)

Accuracy is the first requirement. Then come neatness and promptness in sending reports.

Reports should be sent immediately after ..... No report will be considered if it reaches our offices later than ..... Radio operators must be prompt.

You will need a copy of the amateur codes used. Send today to the Seascout Radio Commodore, 200 Fifth Avenue, New York City. No charge.

CONTEST NUMBER 2

The Radio Amateur Bureau of the Third Naval District has evidence that amateurs in 42 States have received the amateur broadcasts from NAH, but there are many amateurs who are unable to do this, so another contest is needed. Here it is: For the best record proving the reception of a daily broadcast from any Government or commercial station, such as the weather forecast or hydrographic reports (be not afraid of the big word, it refers to icebergs, wrecks, derelicts, mines and other things that get in the way of ships) during the month of ....., we will give

(Insert prize list.)

Hydrographic reports are broadcasted from Naval radio stations at 8 A. M., noon, 4 P. M. and 8 P. M., local (standard) time of station. Each day at noon and 10 P. M., 75th meridian time immediately following the time signal, the Naval Radio Station at Arlington, Va. (Call letters NAA), will

FORMICA

Made from Anhydrous Redmanol Resins

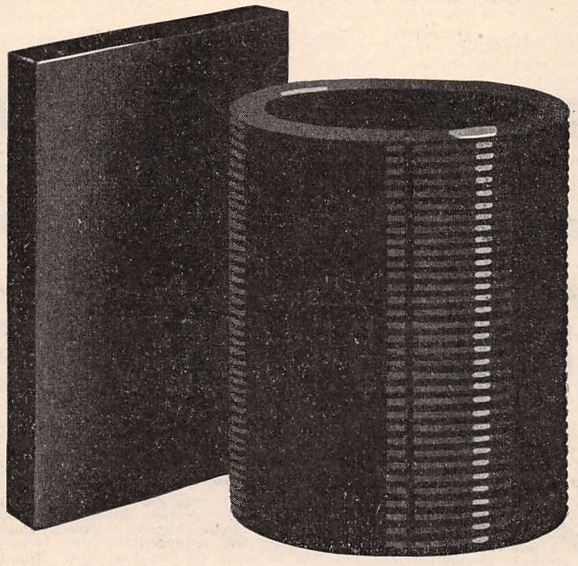
SHEETS TUBES RODS

Good Looks and Perfect Insulation!

FORMICA panels for radio equipment have a splendid gloss or satin finish. They machine perfectly, and encourage neat workmanship. They give you a panel you will always be proud to show your friends! Weather will never affect its looks!

Most radio troubles are due to failure of insulation, to power loss and losses due to hysteresis. Formica has a dielectrical strength of 700 to 1,300 volts per 1/1000 of an inch—and an angle of phase difference so small that hysteresis losses with currents of high frequency are negligible.

The country's greatest engineers approve your judgment when you use Formica!



Dealers: We co-operate with you. You can buy Formica in the sized sheets for which you have the greatest call—or in full sized 42 x 36 sheets which you can cut yourself. Write for our dealer helps!

The Formica Insulation Company

4614 Spring Grove Ave., Winton Place

CINCINNATI, OHIO

Give a thought to your 'Phones

"Superior", 2,000 ohms, weight 14 ozs. complete with head band and polarity indicating cord. $8.00.

The efficiency of any receiving outfit is determined largely by the 'phones used with it. Few amateurs realize this. Badly designed 'phones cannot make the most of the feeble currents that pass through them. It is often possible to multiply receiving efficiency by two when Brandes headsets are used. Actions speak louder than words. Ask your dealer about our ten-day trial offer or write direct.

Brandes are used as *standard* equipment bv the leading manufacturers.

You will be interested in our literature. It tells you something that you do not know about 'phones.

C. BRANDES, Inc.

Room 823

32 Union Square New York City

Member Radio Section Associated Manufacturers of Electrical Supplies.

BRANDES Matched-Tone HEADSETS

broadcast such information relating to safe navigation as may be furnished it by the hydrographic office during the preceding 24 hours. The same wave-length, 2,650 meters, used in the time signal will be employed. Weather forecasts follow the hydrographic information.

Key West, Fla. (NAR), sends weather forecasts on 1,500 meters immediately following 10 P. M. time and hydrographic information (75th meridian time).

Great Lakes (NAJ) sends similar information concerning its district on 1,512 meters at 10 P. M., 90th meridian time.

On the Pacific Coast, San Francisco, North Head and San Diego broadcast similar information at noon and 10 P. M., 120th meridian time, on 952 meters. Local weather reports broadcasted by Tatoosh, North Head, San Francisco and San Diego at 8 A. M. and 4 P. M. on 600 meters and at noon and 10 P. M. on 952 meters; and at noon and 10 P. M. by Puget Sound, Marshfield, and Point Arguello on 600 meters.

Weather bulletins obtained from the United States Weather Bureau at Honolulu are broadcasted daily by the Pearl Harbor Radio Station at 8 A. M., noon, 4 P. M., and 8 P. M., local time.

The above reports usually are transmitted slowly and distinctly.

CONTEST NUMBER 3

Advanced amateurs naturally want to send as well as receive. All right, here is your chance. Of course communication is a team game. To enter this contest you must have another station to work with.

For the best record of maintaining daily communication with another station and handling official traffic for a civic or philanthropic organization such as your City Government or the Red Cross or a Rotary Club or a headquarters of the Boy Scouts of America, we will give:

(Insert list of prizes.)

All conditions will be considered. The fellow with a C.W. set and a special license permitting the use of a long wave and plenty of power will not have an undue advantage over the boy with a spark coil, and a 250 K.W. station a mile away to QRM him. Each report will be judged on its merits. The things that will count are: regularity of communication, accuracy, distance of transmission as related to the type of apparatus used at both stations, neatness of messages as delivered, promptness of service, in fact everything that enters into satisfactory service. Reports should be accompanied by statements from the organizations served showing their records of messages given to you for transmission and messages received through you. Reports of stations which work with each other should be submitted together.

CONTEST NUMBER 4

An all-radio contest. Report to our office by radio that you will enter this contest. Then do what is required by either Contest 1, 2 or 3 and report daily to our office *by radio.*

Our call is ..... Our operator will be on watch daily from ..... to ..... and will stand by on 200 meters. He will arrange special schedules for amateurs who are licensed to work on other wave-lengths if requested to do so.

In judging this contest, the following points will be considered: type of apparatus used, distance of transmission, ability shown in organizing relays to get messages through, wave-lengths, power input, general efficiency.

The prizes are: (Insert list.)

CAUTION

Avoid interference with other stations. The law and your amateur license permit you to transmit only on a wave-length of 200 meters or less unless specially licensed for a longer wave-length. Local amateurs

LEARN WIRELESS AT HOME

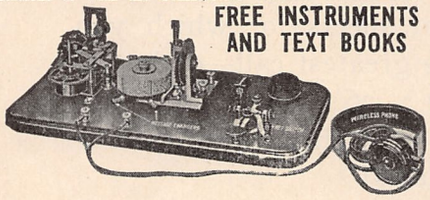
The Demand for Good Wireless Operators Far Exceeds the Supply

The New York Wireless Institute will make you an operator—AT HOME—in your spare time—quickly, easily and thoroughly. No previous training or experience required. Our Home Study Course has been prepared by Radio Experts. Experts able to impart their practical and technical knowledge to **YOU** in an **easy to understand** way. The graded lessons mailed you will prove so fascinating that you will be eager for the next one. The instruments furnished free, will make it as easy to learn the Code as it was to learn to talk. **All you will have to do,** is to listen.

TRAVEL THE WORLD OVER

A Wireless Operator can visit all parts of the world and receive fine pay and maintenance at the same time. Do you prefer a steady position without travel? There are many opportunities at the numerous land stations or with the Commercial Wireless or Steamship Companies.

FREE INSTRUMENTS AND TEXT BOOKS



BIG SALARIES

Wireless operators receive salaries from $125 to $200 a month and it is only a stepping stone to better positions. There is practically no limit to your earning power Men who but yesterday were Wireless Operators are now holding positions as Radio Engineers, Radio Inspectors, Radio Salesmen at salaries up to $5,000 a year.

This wonderfu Set for learning the Code furnished FREE with our Course

We furnish free to all students, during the course, the wonderful receiving and sending set exactly as produced in the illustration. This set is not loaned, but GIVEN to all students completing the Course.

The Transmitter shown is the celebrated Omnigraph used by several Departments of the U. S. Government and by the leading Universities, Colleges, Technical and Telegraph Schools throughout the U. S. and Canada. Start the Omnigraph, place the phone to your ear and this remarkable invention will send you Wireless Messages, the same as though you were receiving them, through the air, from a Wireless Station hundreds of miles away. When you apply for your license, the U. S. Government will test you with the Omnigraph—the same model Omnigraph as we furnish to our students. Ask any U. S. Radio Inspector to verify this.

FREE Post-Graduate Course

A one month's Post-Graduate Course, if you so desire, at one of the largest Wireless Schools in N. Y. City. New York—the Wonder City—the largest port in the World and the Headquarters of every leading Wireless and Steamship Company.

EASY PAYMENTS

A small payment down will enroll you. We will make the payments so easy that anyone ambitious to enter the fastest growing profession—Wireless—may do so.

Send for FREE Booklet

Without obligating you in any way, send for our booklet "How to Become an Expert Wireless Operator"—it is free. Mail the coupon below, or postal or better—but do it today.

NEW YORK WIRELESS INSTITUTE

Dept, 283. 258 Broadway, New York City

NEW YORK WIRELESS INSTITUTE

Dept. 283, 258 Broadway, New York City

Send me, free of charge, your booklet "How to Become an Expert Wireless Operator," containing full particulars of your Course, including your Free Instrument offer.

Name .....

Address .....

City or Town..... State.....

SECOND ANNUAL AMATEUR RADIO

Convention=Exhibition

A Real Radio Convention and a Real Exhibition of Radio Equipment

Pennsylvania Hotel - New York

MARCH 7-8-9-10-11, 1922.

Another year has rolled around and the time for the Second District Convention and Radio Show, the big event of radio, is almost here. Everybody remembers, (for everybody was there), the smashing big success of last year. Well this year is going to add another big success to the history of radio. There isn't any doubt about it, for everybody who was there last year will be on hand again to meet everybody else, and will bring with them all the new converts to the cause created by radiophone broadcasting.

This Simon-pure radio show will be the most interesting and instructive affair of the kind ever held. The general arrangements are practically the same as last year.

The glass-enclosed roof garden of the hotel will be the exhibit hall, and the adjoining Butterfly Room affords an excellent lecture hall, with adequate seating capacity. Only papers of vital interest to amateurs will be presented.

Developments in the new and rapidly broadening field of radio have come thick and fast since last year. Some of them are so amazing in character and so far beyond anything yet generally known to the average radio operator, that any attempt to describe them on this printed page would result only in a very poor and inadequate effort. Come yourself and hear about them and see these new epoch-making devices in actual operation, and you will immediately wonder at the almost unlimited applications of radio to useful purposes.

A banquet for everybody, male and female, will be held on the night of the 11th (Saturday). And it's going to be SOME banquet. This refers both to the dinner and what will be done and who will do it. All the big men of radio will be there.

That dusky-hued girl who was the sensation of last year's dinner will be there again, to demonstrate the last gasp in Hawaiian grass costumes. All male guests will be searched at the door for concealed lawn-mowers.

The Convention and Exhibition will open at 7 p.m., March 7, and will be open from 2 p. m. to 11 p. m. on the following days. A season badge will be sold at the door for 50 cents, covering the five days. One time admissions 25 cents.

The banquet charge will be $4.00. The number which can be accommodated is limited to 600. Tickets will be allotted up to this number only, in the order in which applications are received. Applications by mail should be made to John Di Blasi, 6 Warren Street, New York.

Tickets are also on sale at

Continental Radio & Electric Corporation,
6 Warren Street, New York.

Manhattan Electrical Supply Company,
17 Park Place, New York.

J. H. Bunnell Company,
32 Park Place, New York.

American Electro Technical Appliance Company,
235 Fulton Street, New York.

Wireless Press,
326 Broadway, New York.

This convention-exhibition is held under the auspices of the Second District Executive Radio Council. It is non-partisan, non-sectarian, non-everything—just a straight out and out Second District Amateur Radio Affair, sponsored by all the radio clubs of the Second District.

This is an unparalleled opportunity for material gain, for acquiring knowledge, the making of personal acquaintances, and for general good. It will be the biggest thing ever done in the history of amateur radio.

EXECUTIVE RADIO COUNCIL--Second District

COMMITTEE

J. O. Smith, *Chairman*
326 Broadway, New York.
R. H. McMann, *Ass't. Chairman*

John Di Blasi	A. C. Mills	B. B. Jackson	L. M. Cockaday
A. F. Clough	F. B. Ostman	W. A. Remy	C. E. Huffman
J. B. Ferguson	C. J. Goette	W. J. Howell	J. J. Kulick
C. Hobson	C. E. Trube	R. Hertzberg	

Everything—

The new branches—arcs and tubes—of the revised examination of the Department of Commerce are fully covered in the Home Study Course of the Radio Institute of America.

Enrollments are coming in by every mail. Why aren't you one of the wide-awake wireless men who have seen the new and greater opportunity opened to them by the Home Study Course, which is specially designed to land them one of the enviable jobs at the world's greatest radio station?

It will be equipped to work simultaneously with five other nations in widely separated and distant parts of the world.

A position at this station is the height of every operator's ambition, for it means unlimited opportunity to succeed and progress to higher, more responsible and better paying positions in the radio industry. So far as opportunity goes the successful future of these men is assured.

How about you?

The graduates of the Radio Institute of America enjoy a great and exclusive advantage in the close connection existing between the Institute and the Radio Corporation of America, the world's largest radio manufacturing and commercial radio company.

Prominent executives in the radio field are former students of the Institute. The Radio Corporation employs thousands of men, in its executive departments, on ships and at shore stations and in factories and laboratories. A large percentage of these men are graduates of the Institute.

The Radio Institute of America has been an established and successful institution for over fifteen years. It has trained over 6,000 men, 95% of whom have successfully engaged in this new branch of science and industry.

Write for our booklet and further details—*Now.*

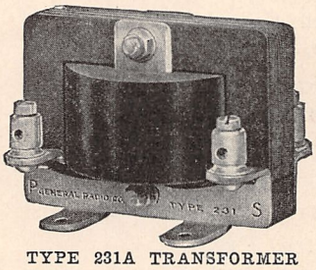
HOME STUDY DIVISION

Radio Institute *of* America

(formerly Marconi Institute)

324 Broadway, New York

AMPLIFICATION WITHOUT DISTORTION



TYPE 231A TRANSFORMER

An amplifying transformer could be made to sell for $1.00. It would amplify, too. An amplifying transformer could be made costing hundreds of dollars. It would amplify much more satisfactorily than the dollar transformer. Both of these cases are extremes, but somewhere in between is a transformer which has the correct number of turns and the correct core dimensions, yet which has no unessential parts, unnecessarily increasing its cost.

Our Type 231-A amplifying transformer was constructed as the result of extended engineering study to obtain a transformer when used with a Radiotron UV-201 tube would give the maximum amplification of signals without distortion. To accomplish this, the winding is correctly designed both in regard to turn ratio and the method of winding. The winding is such that the distributed capacity is kept at a minimum so that telephone signals will not be distorted and at the same time is rugged mechanically so that open circuits will not occur. The core is such that saturation will not occur causing signal distortion and also is so designed that eddy currents will be reduced to a minimum.

Multi-stage, audio frequency amplification is neither necessary nor desirable for ordinary work. Two stages of amplification with properly designed transformers is all that should be required. Why not use a transformer which will give you all the amplification necessary in one or two stages?

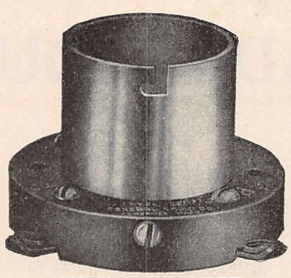
PRICE, COMPLETELY MOUNTED, $5.00

A vacuum tube socket plays an important part in amplification. The prongs of the tube must make perfect contact to prevent the introduction of noises. The springs in our Type 156 vacuum tube socket are so arranged that contact noises are entirely eliminated.

RUGGED ATTRACTIVE RELIABLE

PRICE $1.50

Send for
Free Radio Bulletin 910N



TYPE 156 SOCKET

GENERAL RADIO COMPANY

Massachusetts Avenue and Windsor Street, CAMBRIDGE 39 MASSACHUSETTS

Standardize on General Radio Equipment Throughout.

can arrange schedules which will give all a fair chance. Get together.

Contests begin ..... and end ..... Written reports must reach our office not later than ..... Reports by radio should be made daily, the last one not later than .....

JUDGES

The following well-known men have consented to serve as judges:

(Suggestions: Radio Inspectors of the U. S. Department of Commerce; Communication superintendents, U. S. Navy; U. S. Army radio men; Post Office Department radio men; advanced amateurs.)

PRACTICE

Begin now to copy Government and commercial traffic, for practice. Of course you understand that it is illegal to let anyone know what you receive except in the case of messages from a Government station addressed "QST."

Here's wishing you all success in your efforts to win prizes and become competent operators.

Such contests will develop numbers of reliable young operators who can be depended upon for service in an emergency. Such operators are needed more today than experimenters, of which we already have a flourishing crop. A hundred boys who use radio apparatus simple and cheap enough so that their neighbors can understand it—use it day in and day out to get the weather and the time and the news and maybe a concert in the evening—will create more business for a radio dealer than a thousand geniuses in the same territory who, with complicated outfits and technical talk spread the idea that radio can be used only by a wizard.

DEALERS TALK OVER THE HEADS OF CUSTOMERS

A letter that the postman brought just as I was writing the above paragraph illustrates what the average radio man is doing to the millions who would like to have receiving sets in their homes. It reads:

"I would like to procure a set with a radius of say 300 to 500 miles, what it would cost and how to assemble and where could I get same? I have asked questions galore of our local man here, but can't make head or tail out of what he says, away above my head. I am no millionaire so will have to be content with small set."

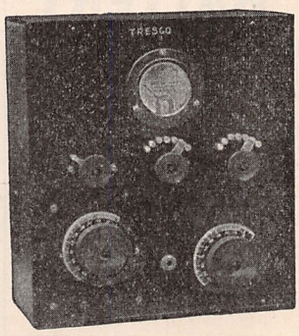
If the dealer in that man's city had been on his job he would have had in the prospective customer's neighborhood boys galore who would have answered the questions galore and he would have sold receiving sets galore. Now I've got to sell this one for him. That's all right, but he is losing the sale of a thousand or more in the meantime—a thousand that he could have pushed over the counter like cakes of soap. He could have collected a profit which in the aggregate would have far exceeded what he can get out of higher priced sets that sell with far more difficulty and expenditure of time.

Keeping the boys at work is the one thing that will save the dealers from headaches over the present situation. They have been busy convincing the world that the mineral detector set is becoming obsolete. Where they have succeeded that means that a lot of those sets were never made and sold when they might just as well have been working and making new customers. Now it seems probable that the popular vacuum tube sets that scrapped the mineral detectors are going to be shoved into the dump themselves by better ones that can be hung on the wall and operated without antenna or ground,—self-contained, easy-to-operate, practically fool-proof receivers that will be snapped up by folks who can afford them. I used one recently that was in an easy-to-carry suit case, antenna and everything. It had three steps of radio

and one of audio amplification and a loud speaker. It talked right out loud as I walked along, bringing me personal messages from a friend miles away. But the market for the lower-priced mineral detector sets will be there just the same because there will be ten times more folks who never will have money enough to buy the more expensive stuff until they have used something cheaper and have come to think of radio as a household necessity.

Most women would rather have a vacuum cleaner than a broom, but many are still using brooms. If the broom were not constantly teaching the blessings of cleanliness a lot of them would not care a whoop about the vacuum cleaner. We all like to have a good seat at the theatre, but most of us acquired the theatre habit by sitting in the peanut gallery. The vacuum cleaner

Portable Wireless Phone & C.W. Transmitter



Voice Range 15 miles using Amateur Aerial and 90 volts-Flash Light Batteries.

Phone $45.00
90V. Battery $10.00
Transmitter $6.00
Bulb UV202 .... $8.00

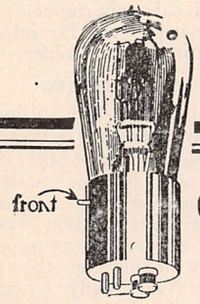
Increased range with higher voltage. Easy to operate. Knocked down parts $35.00

TRESCO TUNERS—one for every wave length $10.00

TRESCO CONDENSERS—All kinds; see us before buying elsewhere.

10c Brings Our Catalog—24 Pages

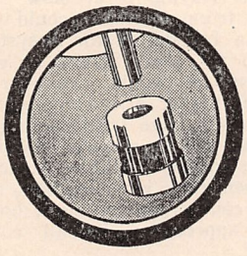
TRESCO - DAVENPORT - IOWA



DEALERS: *A very healthy demand has sprung up all over the country for the RADECO Safety Fuse. For the convenience of your customers you should have this profit maker in stock. Write today for dealer's price list. The RADECO Safety Fuse now comes packed in handy boxes of four.*

Costs BUT A *Few Cents*—Saves *Many Dollars*

Standing on an absolutely impassable barrier between the delicate filament of your tube and high amperage from any other part of your set the



RADECO SAFETY FUSE

(patent pending)

The Radeco Safety Fuse operates on the same principle as any other fuse. It is applied as shown in the illustrations above. Carrying capacity 1, 1¼, 1½, 2, 2½ and 3 amperes. On Vacuum Tubes it is best to use one fuse on each terminal of the filament.

saves many, many times its cost by protecting bulbs positively against "burning out" from any short circuit, accidental or otherwise.

This fuse slips directly on the filament terminals of any standard bulb used in any standard socket and does not in any way affect the efficiency of your set.

Sold four in a box only **4 *for* $1** **Order by mail or from your dealer**

The RADECO Safety Fuse is equally good for protection of meters and other delicate Radio Instruments.

Special Bargain in STORAGE BATTERIES

6 Volt—80 Ampere Hours

—a special lot of brand new batteries made by a well-known manufacturer, exactly right for radio use. These batteries are not rebuilts, but *new batteries.*

$12

An opportunity at this price

The BIGGEST RADIO VALUE Ever Offered

Clapp-Eastham Type HR

REGENERATIVE RECEIVER

—most compact, accurate and simple set ever offered amateurs. Wave-length 180 to 825 meters. Size 7¾ x 9⅜ x 6¾ inches over all. Compartment *inside* for "B" Battery Balanced Type Condenser. Dull Finished Formica Panel. Works over surprising distance. Is *Guaranteed* to Give Results.

$35

DELIVERY PREPAID

Order this Bargain by Mail At Once

We carry a complete line of Radio Apparatus of standard make at standard prices. Order by mail from any standard catalog. Prompt delivery.

Reliable Goods at Right Prices

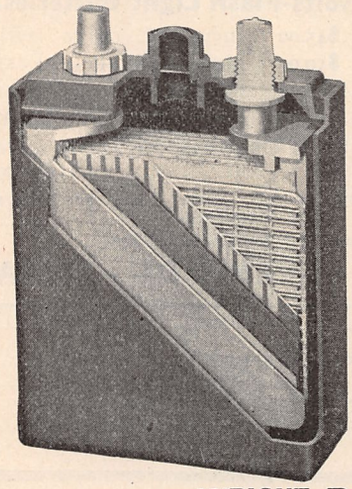
RADIO EQUIPMENT CO.

630 Washington St., (4th Floor) Boston, Mass.

New England's Oldest Exclusive Radio Store

The New Portable Size WRIGHT RADIO SPECIAL

THE ONE PERFECT "A" BATTERY



The same super quality as those used in the receiving equipment of the NEW YORK TIMES Radio Department and made and guaranteed by the same manufacturers.

The experts of the "TIMES" operating the largest and most complete newspaper receiving station in the U. S. had experienced the same kind of troubles as the amateur who tries any old battery that comes to hand, but they, of course, had the pick of the best that manufacturers could offer. Other well known batteries which had been tried out failed to meet the new requirements, made particularly exacting on account of the heavy 24 hour demand. THEN THE BATTERY EQUIPMENT WAS STANDARDIZED.

Now after 6 months of continuous service, and repeated tests by eminent authorities, all three of the WRIGHT BATTERIES, exclusively used and rated at 150 ampere hour capacity, are delivering more like 200 and the performance and condition are 100% O. K.

You can have the same quality service in the most convenient form—TAKE THIS SPECIAL 30-DAY INTRODUCTORY OFFER.

WRIGHT RADIO "A" BATTERY

PORTABLE, 6 Volt, 7 Plate, 45-60 Ampere-hour with Acid-proof Terminals. Strap Handle, and Handy Connectors. Shipping Weight 35 lbs. **ONE for $13.50**

TWO TO ONE ADDRESS, $26.00. SIX (Shipping weight 175 lbs.) FOR $75.00.

Large Portable, 6 Volt, 11 Plate, 80-110 Amp-hour. Same perfect Terminals, Connectors and Handle. Weight about 50 lbs. **ONE for $19.50**

TWO TO ONE ADDRESS, $37.50. FOUR FOR $72.50.

Commercial Type WRIGHT RADIO "A" BATTERY

Large plates in Glass Cells (like N. Y. Times). (For those having charging sets)

6 Volt (3 glass cells) 7 plate, 100-130 Amp-hour. **$25.00**

ALL SHIPMENTS F.O.B. NEW YORK OR MILWAUKEE

Cash with order or C.O.D. on receipt of $2 per battery.

Commercial sizes to 300 A. H. Also full line of Parts. SEND FOR CATALOG

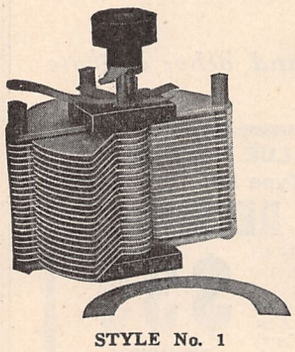
RADIO DEPARTMENT

ELECTRICAL & ENGINEERING CORPORATION

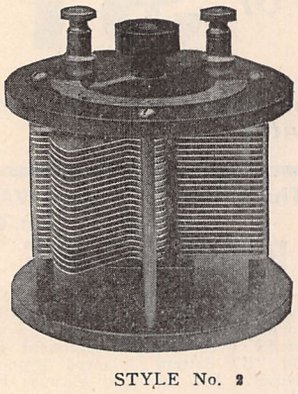
716 EIGHTH AVE. Phone Bryant 6873 NEW YORK, N. Y.

"ILLINOIS" THE RELIABLE

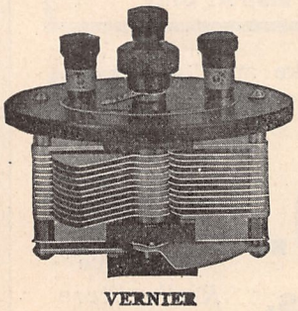
MADE RIGHT - STAYS RIGHT



STYLE No. 1



STYLE No. 2



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Three Styles: No. 1, Panel; No. 2, Open Type as shown; No. 3, Fully Encased. Anti Profiteer. Less than pre-war prices. Fully assembled and tested.

Style No.	1	2	3
67 Plates,	$7.00	$8.00	$8.50
43 "	3.50	4.50	4.75
23 "	2.75	3.75	4.00
13 "	2.25	3.25	3.50

Money back if not satisfied. Just return condenser within 10 days by insured Parcel Post.

Options:—With Style No. 1—instead of Scale and Pointer, a 3-inch Metal Dial at 50 cents extra, or a 3-inch Bakelite Dial at $1.00 extra. Large Knobs. Both excellent values. Or we will, if desired, supply the Condenser with smooth 3-16 inch center staff, without Scale, Knob and Pointer, at 15 cents off the list to those who prefer to supply their own dial.

Vernier with single movable plate applied to 13, 23 or 43 plate condenser, $3.00 extra.

We allow no discounts except 5 percent on orders of 6 or more.

Sent Prepaid on Receipt of Price

Except: Pacific States, Alaska, Hawaii, Philippines and Canal Zone, add 10c. Canada add 25c.

Foreign Orders other than Canada not solicited.

G. F. JOHNSON, 625 Black Ave., Springfield, Illinois.

manufacturer knows that his business depends upon the habit of cleanliness and the theatre man knows that he cannot fill the boxes unless he or some other fellow maintains a gallery. Neither would be so foolish as to let the foundations of his business decay and the foundation of any business is a common habit formed in childhood which ensures the use of its product by the masses and the desire for something better.

Once again I must refer to the neglected opportunity in the Boy Scout organization. Since my last reference to it, it has grown to the tremendous membership of 530,000. It is the largest uniformed organization in America. About 119,000 of that number are volunteer adult leaders. Every Scout learns the International Morse code. Every one of them would be "tickled sick," as one expressed himself, if he could realize that he could own and operate a set that would bring in the official messages from NAH, and traffic of local importance. But not many of them can go very far into experimental radio until they are older.

START SOMETHING

Dealers say that they are willing to cooperate, but they seem to be waiting for the Scout officials to take the initiative. Few of them will, because Scoutmasters are volunteers and in the afternoon and evening that they give to their troops they have a score of other matters to attend to.

A dealer by picking up the Amateur Broadcast from NAH daily (9:30 P. M., Eastern Standard Time, 1,832 meters, spark) and relaying it at slow speed so that every troop operator could copy it, would lay a foundation for a system that would keep the local Scouts at work on radio. Also he would demonstrate the value of his higher priced equipment in a way that would have tremendous publicity value. With such a service established he could invite in the would-be Scout operators, sell them their receiving sets, and give the local Scout organizations a boost that would be appreciated by all concerned. Why wait?

There are other fields, too, which are being covered by the more progressive manufacturers and dealers. Over in Boston the Amrad people put the kids to sleep evenings with a Burgess bedtime story and put the old folks to sleep Sunday with a sermon. Think what an argument such a system places in the mouth of an active boy who wants a real radio outfit. It is the boy in the family who usually feels the need of radio first and gets action out of the others.

The radio dealer who fails to keep the boys at work is depriving himself of one of the greatest influences in the world—traditions. The activities in which boys engage in an organized way give rise to traditions that are kept green from year to year and that keep those activities in the public eye. Already the American Radio Relay League has an *esprit de corps* that pulls boys and men across the continent to attend its meetings. It is because it gives its members real work to do. One of the most enthusiastic and prominent figures at the First National Convention was a boy not yet in his teens. If this can be done nationally it certainly can be done locally, where boys and men come to know each other so much more intimately. School and college classes, campmates, groups of many kinds get together to talk over old times. Inside of a year after starting a system that would utilize boy operators a dealer could start reunions from which tales of getting the messages in spite of QRM and QRN would go out and make every boy in town feel that he did not amount to much unless he had a radio station.

From Moses to Sarnoff and from Napoleon to Dubilier the men who have done big things have begun early in life. The dealer who says that boys are too young to be kept at work will never establish in any-

body the habit of going to the old stand when they want the right goods at the right price, but he who takes time today to encourage the boys to keep at work will have a solid clientele ten years from now and a lot of satisfaction that is worth more than that which comes from cash profits.

Some Practical Points on Arc Operation

(*Continued from page 701*)

the converter, yet it is obvious that if the total C.W. wave is not smooth and regular, the chopper note cannot be regular.

Necessarily then, there are several prerequisites which must be adhered to before a musical note in the chopper emission can be made. The arc voltage, the hydrogen production, the blast and the arc space must be adjusted for a clear C.W. wave form before any attempt may be made to-

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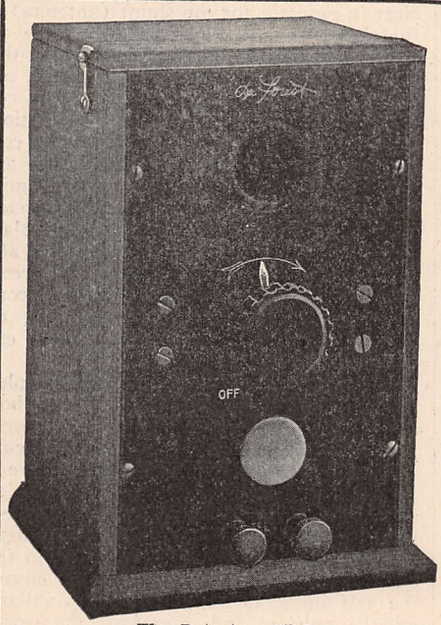
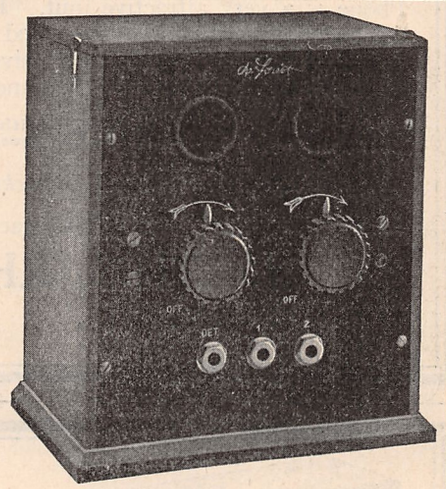


The Detector—SP-1

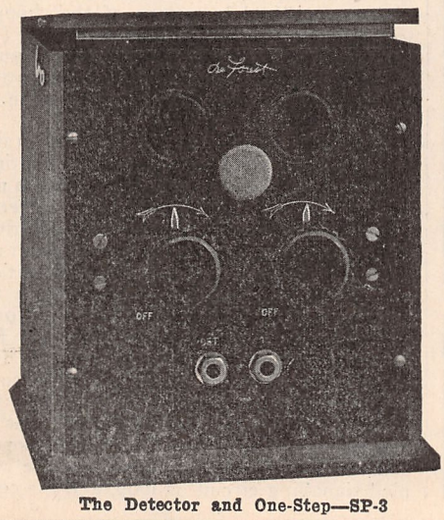
A NEW DEFOREST LINE OF RECEIVING INSTRUMENTS



The Two Step Amplifier—SP-2

THE SP SERIES

The SP Line has been designed for the amateur who appreciated appearance and efficiency—with compactness. All panels are but 7⅜ in. high and the widths vary from 4½ in. in the case of SP-1 to the 8⅞ in. of SP-4. We wish to call attention to two features included in the construction of these instruments: Binding posts on the rear of cabinets and filament control jacks. The attractiveness of these sets is not marred by wires criss-crossing across the fronts of panels. Input wires, A and B battery leads, tickler connections are all brought to bakelite binding posts set in bakelite inert strips in the back of cabinets. All that projects from the panels of SP instruments are the filament control knobs and the nickeled case of the variable grid leak. Unless one has enjoyed the convenience of two-circuit, filament control jacks it is hard to appreciate this feature which saves batteries and constant re-adjustment of rheostats. Only those tubes are lighted which are in use and amplifying transformers not in use are completely disconnected. Panels are of engraved 3/16" bakelite, the letters being filled in with white that will not chip out or peel off. Hinged tops permit ready access to the interiors for insertion of vacuum tubes and inspection. The SP line in efficient, deluxe equipment at moderate prices.



The Detector and One-Step—SP-3

PRICES F. O. B. NEW YORK

SP-1	$18.50	SP-3	$42.00
SP-2	48.00	SP-4	65.00

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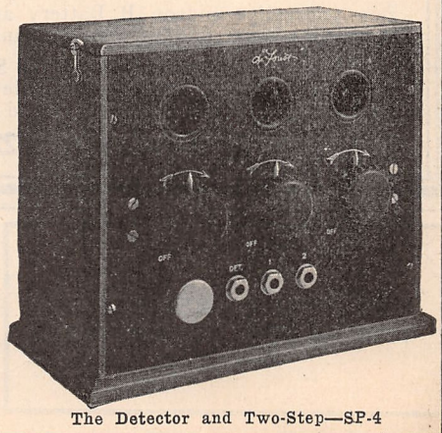
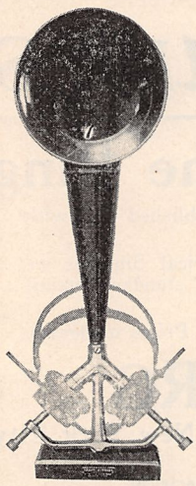


The Detector and Two-Step—SP-4



RHAMSTINE ★

Introduces the
ADAPT-O-PHONE

In the most convincing manner the Rhamstine* Adapt-O-Phone fulfills the demand for a satisfactory loud-speaker at a reasonable price. Reference to the cut will show a standard headset held in position against the special manifold by knurled screws —your own receivers are used—readily inserted or removed. One can quickly understand that the sounds from two receivers of matched tone, are more audible than if but one receiver is used. Herein is a valuable feature of the Adapt-O-Phone. Sounds from the two receivers enter the small end of the horn, are rounded out and amplified in clear undistorted tones.

In addition to its being a most satisfactory loud-speaker, the Adapt-O-Phone is a very attractive unit. The horn is metal, black japanned; the manifold casting heavily plated and polished and is equipped with rubber sleeves to protect the receivers. The base is of wood finished in hand-rubbed mahogany. It stands 20″ high.

PRICE Without Receivers **$12.00**

Add 25c for Postage and Packing; West of Rocky Mts., 40c.

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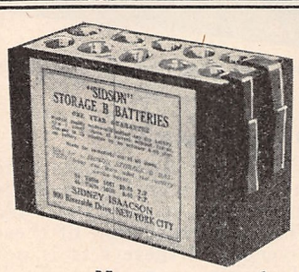

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Rechargeable Variable

No. 1001	24 volts—size 1¾ x 4 x 2½	$3.00
No. 1002	44 volts—size 3½ x 4 x 2½	4.50
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The Sidson B Battery will operate in a circuit of three vacuum tubes and is variable from 2 volts up.

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ward the production of a chopper note of musical form and intelligent audibility.

Directly connected with the emission of a pure chopper note is the necessity for the regular spacing of the bars of the chopper commutator. The necessity for this will show in our discussion of the manner of signalling using the compensation system, which follows.

It is hardly necessary to state that to transmit signals, the Morse key cannot be inserted directly in the antenna. When the converter is connected to an antenna of a certain capacity and the production of radio frequencies is accomplished by proper adjustment of the arc converter and all the auxiliary items, which have a vital bearing on the action of the arc, the breaking of the antenna circuit by the manipulation of the key would in most cases extinguish the arc if placed at a point close enough to the ground for the operator to manipulate it, because the capacity of the oscillating circuit would be instantaneously changed and for the given adjustment of all the necessary items in connection with the arc gap, the circuit would in all probability be insufficient in capacity for the shunt (antenna) to function as an oscillator producing the desired emission. It must be remembered that an arc converter is quite an obstinate and headstrong piece of apparatus, as a colleague puts it, and will produce oscillations only over certain ranges under given conditions. The proportion of inductance and capacity must be confined to certain limits, and even though those limits are respected, the adjustment of the gap and the blast, the cooling and the E.M.F. must be also carefully respected. Signalling by breaking the antenna circuit directly, if accomplished, would be totally undesirable, especially when much simpler and more efficient means are available.

When two circuits are tightly coupled, and R.F. current flowing in one or both of them, there is a mutual reaction between them. Taking the case of two such circuits and with current flowing in one, there is also a transformer action and a considerable value of mutual inductance between the two. If an open oscillator (or a closed one) with energy flowing in it at radio frequencies, has coupled to it a closed circuit, the self inductance of the open oscillator will be reduced and, therefore, the period of wave-length (frequency). If the coupled circuit is opened the total self inductance of the open oscillator will be restored in approximately full measure. Therefore it is obvious that when the coupled circuit is closed, the open oscillator will emit radio frequencies at one wave-length and frequency, while during the period when the coupled loop is open, the open oscillator will emit energy at another wave-length (frequency). Thus the simple solution of arc signalling by the compensation method, which is utilized by means of the chopper to produce a non-continuous emission (interrupted) trains of continuous waves, audible after simple unidirectional rectification, such as by means of the plain valve or crystal action.

Referring to Fig. 1, there is illustrated a representation of wave forms of continuous amplitude, (a) 300,000 cycles (1,000 meters), (b) 500,000 cycles (600 meters). For simplicity, these wave forms are given with peaked maximums, which although not true sine form, yet serve for illustration. As it will be remembered, neither are the arc converter oscillations of pure sine form, but irregular, although persistent and following in exact sequence at a given frequency. (e) Let us assume the alternate light and shaded portions to represent the conducting bars and insulating portions of the copper commutator. With the chopper commutator inserted in series with the coupled signalling circuit or loop, and the com-

mutator revolving at a given speed, it is obvious that the chopper loop or signalling loop will be alternately closed and opened in conformity with the passing of the given segments past the chopper commutator crusher. Harking back to the previous statements, it is plain that if the open oscillator or antenna has radio frequencies flowing in it, say from the productions of an arc converter, the opening and closing of the coupled chopper loop will alternate the mutual inductance between the two circuits and therefore will alternate the wave-length of the antenna between the two values, as shown at *d*. At *c* we may represent roughly the alternating frequencies flowing in the antenna. Now in conformity with the variation of the wave-length of the antenna through the action of the chopper loop in varying the mutual inductance of the antenna, the resistance of the latter to radio frequencies is changed also, as is shown roughly and comparatively at *f*. As the frequency of the antenna is changed, as well as the inductance and the mutual inductance between the two coupled circuits, the resistance at radio frequencies is also changed, and therefore the amplitude of the current flowing in the antenna is changed. The current, with the chopper in operation in the compensating loop, and also true in other cases, depends directly upon the total antenna resistance at a given wave-length (frequency).

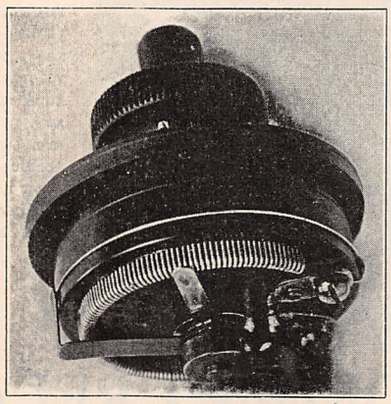
At *g* and *h* we represent the signalling and the compensating waves which are produced by the action of the chopper when the loop is closed by the Morse key. Although the key closes the loop apparently, the rapid shifting of the commutator segments past the brushes alternatively closes and opens the chopper loop at a fairly high rate of speed, which in the case of the Federal 2 K.W. sets can be ascertained from the fact that the commutator has 24 segments and the speed of the commutator is 1750 (normal) revolutions per minute. (For various reasons the commutator has interspersed five other segments between each two of those actually carrying the loop current as they pass the brushes.) The note produced without chopper speed adjustment is a pure sharp, pleasant musical note of about 700 cycles, which may be said to be close to the normal rate of vibration of the ordinary voice. At *i* and *j* are illustrated the comparative relations between the rapid alternations of the antenna current between the signalling and compensating waves, and broken into characters of the Morse code. The trains shown in the signal wave are represented as made up of only a few alterations due to lack of space in printing the illustration. The number of actual oscillations may be great in number, depending upon the particular frequency of the signal wave (therefore the wave-length).

At *k*, *l* and at *m*—are represented the rectified received current from the chopper signalling wave, the phone diaphragm vibration following each wave train, and the resultant duration of sound at the receivers if acoustic reception is employed, the whole broken into the characters of the Morse code.

Harking back to the sixth paragraph of this article, we stated that under certain conditions the speed of the chopper made no difference in the production of a musical note. We may present a slight modification of that statement here. With the use of the "ignition key" system of signalling where the arc is alternately extinguished and lighted in conformity with the rise and fall of the Morse key, it is well to state, that unless the converter is quite warm and has been in operation for some time, there may be some difficulty in obtaining a really pure note, owing to some small irregularities in operation due to the rapid lighting and extinguishing of the arc. With these irreg-

Something entirely new

VERNIER RHEOSTAT



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Vernier Rheostat, which allows very fine control of the filament current for V.T. use.

Can you maintain that critical adjustment on your vacuum tube?

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With our **Vernier Rheostate** it is possible to obtain variations of one one-thousandth (1/1000) of an ampere.

Our attachment does not interfere with any previous method of panel or table mounting.

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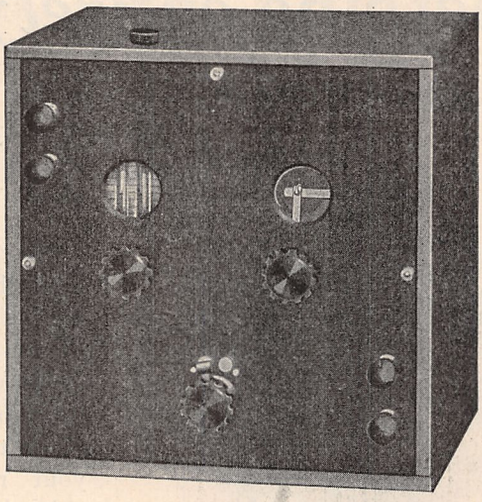

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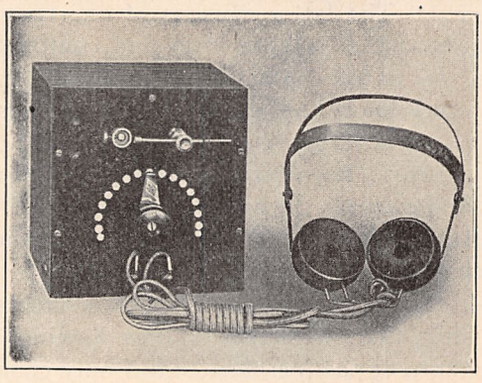

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1 cabinet, containing tuning inductance, crystal detector, fixed condenser, etc.
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ularities, there is a slight difference in the continuity of the frequency and amplitude of the emitted signal wave, and the adjustment of the speed of the chopper commutator will render some slight aid in obtaining a pure note especially when the converter is comparatively "cold." After a short period of operation, the note will generally be maintained pure over quite a range of commutator speed.

Summing up, to produce the desired successful operation of the chopper especially on merchant vessels, where a specific type of apparatus is employed (generally that of the Federal type) there are several special but simple details which must be adhered to strictly, to produce the best of results. First the converter must be operated at the steepest point of the characteristic curve for maximum production of radio frequencies. This can be most easily and simply accomplished without any special technical knowledge of the intricate functions going on within the chamber, and which by all means are in a manner complicated in themselves, but their handling by the common aids attached to the modern type of converter, are easily accomplished. Attention to the specific and fine adjustment of the arc gap, the voltage, the hydrogen production, care of the direction and strength of the blast, continuity of the magnetic circuit, exclusion of water even in the minutest quantities from the chamber, clean cut carbons, proper cooling (both chamber and anode), cleanliness of the chopper commutator, careful survey for antenna insulation (highly and vitally important), scrupulous cleanliness of all R.F. parts, and the chopper signalling with the converter will be easily and quickly accomplished. If these are carefully taken care of, there should be no reason why the mechant ship arc operator can lay the blame for the irregular operation of the converter on the fact that "the wires are too large to radiate a musical note."

I think you will agree with me that when we have found a means to synchonize the mechanical vibration of the wires with the electrical vibrations of our oscillators, we shall indeed be able to radiate more than musical notes.

Etherless Wireless

(*Continued from page 703*)

tion of the earth which is in play for the reception of waves from certain wave-lengths. It is also probable that such an antenna uses as much ground as is necessary for different wave-lengths. It therefore is extremely flexible and there is absolutely no natural period, but only the period of the wave being received. Experiments of this nature could be easily conducted where the time and material and necessary apparatus is at hand, by using a buzzer transmitter on the wavemeter side, and adjusting the receiver to various wave-lengths to correspond with the transmitter. No change in the distance between the transmitter and receiver is necessary. Notations should be made on the intensity of signals received on various wave-lengths over a broad range.

In order to increase the strength of signals I described a circle with a radius of 10', by driving iron pipe into the earth and soldering a heavy No. 10 wire to all of them. See Fig. 3.

With such an antenna and an ordinary regenerative receiver signals from vessels at sea were copied up to a distance of 400 miles.

It is to be noted that before that point is reached where the resistance of the earth becomes too great a much larger circle is described. This increases the receiving range of the antenna.

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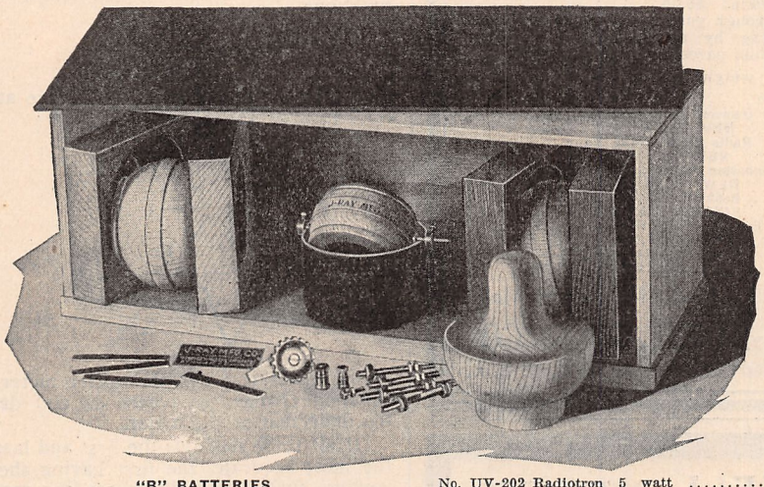

A KNOCKDOWN RECEIVER FOR $15.50

SET CONSISTS OF—1 Stained oak cabinet 18 x 7 x 7, removable top and back, polished FORMICA panel 18 x 7 x ⅛ to fit cabinet, 2 variometers, 1 FORMICA coupler tube, 1 secondary ball, 1 switch lever, 6 binding posts, 7 switch points, 2 switch stop, all necessary brass parts screws, etc., for assembling the set together with a winding form to be used for winding inside of variometers.

PRICE $15.50 as shown in cut;
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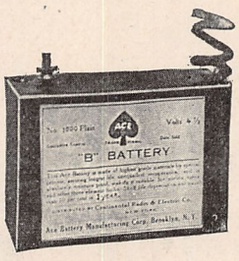

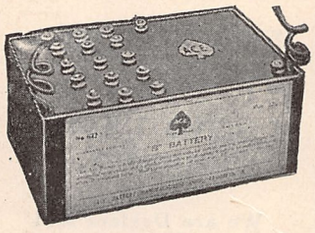

This cut shows the Ace special 45 volt variable battery which is going strong and showing the way as to being the one Battery to meet all "B" Battery requirements. Size 6x5x2⅜, weight 3¾ lb. Price.....$3.50

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623 Variable	2½x2x3⅜	22½	1	5	1.75
625 Plain	3 x4x6⅝	22½	5		2.50
625 Variable	3 x4x6⅝	22½	5	5	3.00
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626 Variable	3 x8x6⅝	45	10	6	6.00

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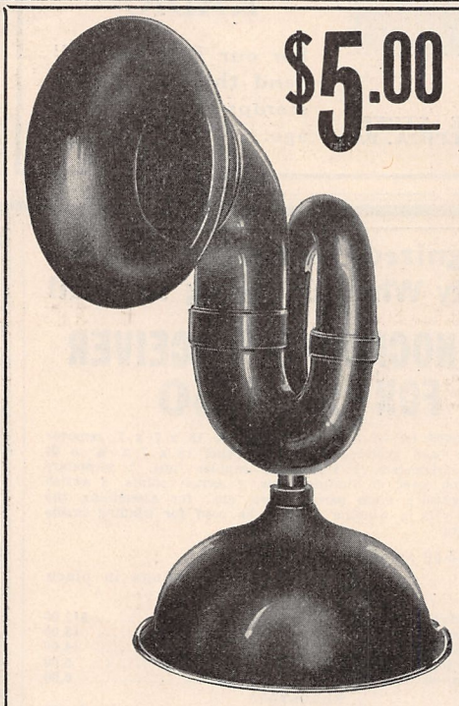

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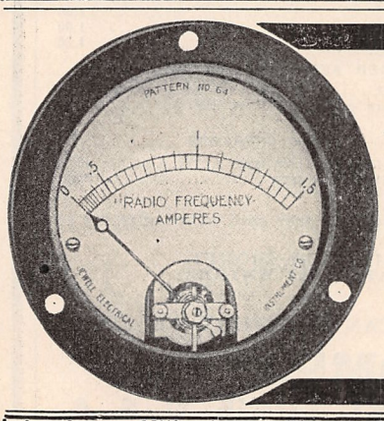

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I do not vouch for the theory I have offered, but it is quite natural that I would seek some explanation. Any of our kind readers having experienced similar results with ground receiving devices, are cordially invited to discuss their beliefs, and the author will be glad to hear what they have to say on this subject.

A Study of the Antenna System

(*Continued from page 703*)

the antenna decrement. Now from equation 2 above we see that the decrement is directly proportional to the antenna resistance. So that if we double the antenna resistance, we double the antenna decrement. But equation 3 shows that if the antenna decrement is doubled, the square of the antenna current is halved. Thus a method is obtained. The antenna is excited by the wavemeter and the resonance squared current obtained. Now insert resistance until the current squared in the antenna as read by the thermo-galvanometer is reduced to half the resonance value. This inserted resistance is then equal to the antenna resistance. This method is thus seen to be also a direct method involving no calculation. Its disadvantage as compared to the first method is that a very high decrement wavemeter is difficult to get, consequently certain corrections must be made.

4 Added Resistance Method: This is the standard method employed in the measurement of all radio frequency resistances. The circuit used is shown in Fig. 2. The antenna circuit is coupled to a source of undamped waves and tuned to the source; an e.m.f. is induced in the antenna coil and the current is given by the following equation:

$$i_1 = \frac{E}{Ra + R} \qquad (4)$$

where Ra is the antenna resistance, R the resistance of meter and coil. An additional resistance of known value R_1 is now inserted and the current now is given by the equation:

$$i_2 = \frac{E}{Ra + R + R_1} \qquad (5)$$

From these two equations we arrive at the resistance of the antenna as

$$Ra = \frac{R_1}{\frac{i_1}{i_2} - 1} - R \qquad (6)$$

$$Ra = \frac{R_1}{\sqrt{\frac{d_1}{d_2}} - 1} - R \qquad (7)$$

If the meter is a current square meter, the equation changes to where d1 and d2 are the deflection of the meter.

Of all these methods the first and last are the most accurate, the first having the advantage that it is a direct reading method, the resistance being obtained without any calculations. The third method is the simplest requiring but little apparatus and can be used at almost any place without difficulty. It is, however, the least accurate.

INDUCTANCE AND CAPACITY MEASUREMENTS

Both the inductance and capacity of the antenna can be measured by one experimental method. This method consists in the use of two loading coils. A loading coil of inductance L_1 is inserted in the antenna and the wave-length of the antenna then determined. The wave-length is then given by the equation:

$$\lambda_1 = 1885 \sqrt{(L_1 + La)\, Ca} \qquad (A)$$

Another loading coil of inductance L_2 is now inserted and the wave-length again meas-

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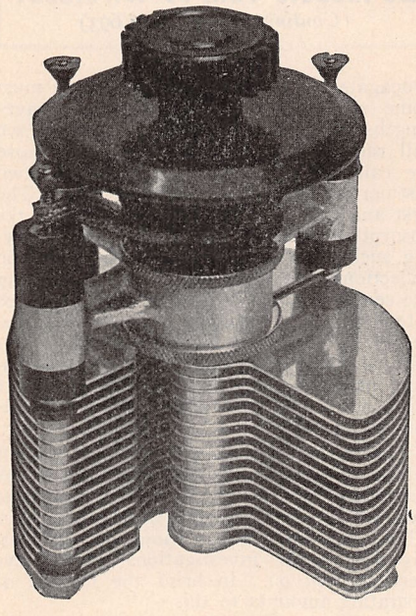

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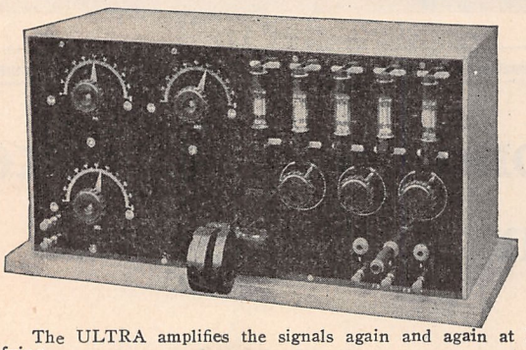

TESTIMONIAL

The Ultra is one of the prettiest instruments that I have ever seen, both inside and out and few improvements could be made in it. And the results are in proportion. I have copied amateurs in every district on a small indoor loop with the Ultra and a 100 watt 'phone set in California comes in all over the house. Using a four step amplifier (Audio Frequency) in connection with the Ultra and a Magnavox signals are readable a mile and a half from the receiving set. Yours sincerely and in praise of the ULTRA. Signed William H. England, Jr., Ponca City, Oklahoma.

The ULTRA amplifies the signals again and again at RADIO FREQUENCY before rectifying.

REMEMBER an Audio-frequency amplifier will amplify only signals which the most sensitive detector will rectify. The proper place for your audio-frequency amplifier is to connect it to the output of the ULTRA.

The ULTRA will respond and amplfy to an enormous value, damped wave, continuous wave, interrupted continuous wave, and telephone. It employs a circuit which makes short wave amateur reception and RADIO frequency amplification possible and avoids the necessity of adjusting each successive stage of amplification with each change of wave length received. Any wavelength may be readily adapted by simply inserting proper sets of coils.

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ured. The wave-length is then given by this equation:

$$\lambda_2 = 1885 \sqrt{(L_2 + La)\ Ca} \qquad (B)$$

From these two equations the antenna capacity may be eliminated and the antenna inductance is then given by the resulting equation:

$$La = \frac{L_2 \lambda^2_1 - L_1 \lambda^2_2}{\lambda^2_2 - \lambda^2_1}$$

Knowing λ_1 and λ_2, L_1 and L_2, we can solve for antenna inductance La. Having thus determined the value of La, this value is substituted in equation A or B and the equation thus obtained is solved for the antenna capacity Ca.

Another method for the determination of the antenna capacity is based upon the idea of antenna reactance. In the first part of this study the idea of antenna reactance was explained. It was shown that the antenna could be considered as a reactance. This reactance was due to the capacity of the antenna and the inductance of the antenna. At very high waves the inductance reactance of the antenna is negligible compared to the capacitive reactance of the antenna. Consequently we may consider at these high waves that the reactance of the antenna is due entirely to the capacity, and is $\frac{1}{\omega Ca}$. When we load the antenna with an inductance, therefore, to a definite high wave-length, the antenna will be resonant to this wave-length. That is the capacitive reactance due to the antenna neutralizes the inductive reactance due to the loading coil. Hence, since the inductive reactance is ωL, we have

$$\omega L = \frac{1}{\omega Ca} \qquad (C)$$

The method, therefore, consists in loading the antenna with a known inductance, measuring the wave-length of the antenna loaded and finding the corresponding frequency. Knowing L, ω, we can determine the antenna capacity from the equation of reactances, (C).

These are the principal methods of determining the constants of an antenna, and it is desirable that these constants be known as they are very important when questions of the design of sets arise.

Do Insects Talk by Wireless?

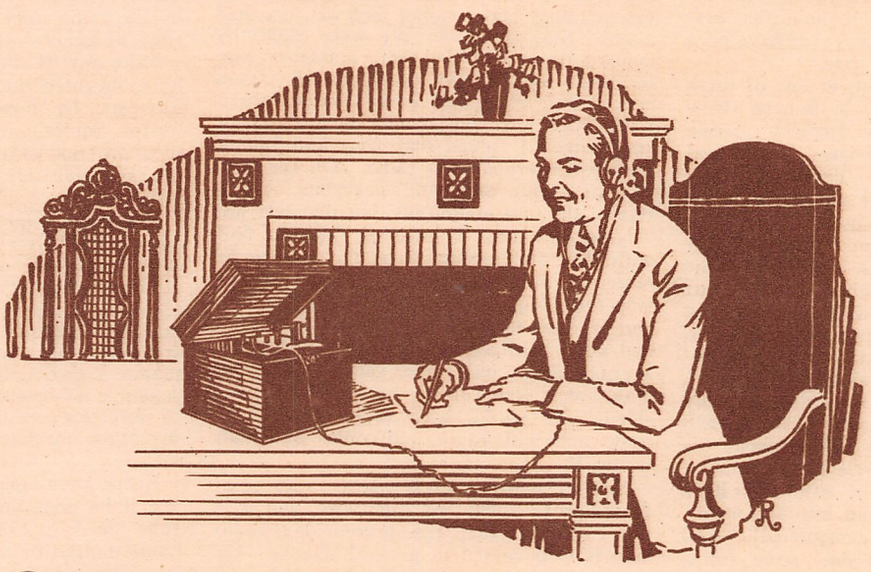
(*Continued from page 693*)

propagate electromagnetic waves, they must come somewhere in the range of wave-lengths between the shortest of those we call radio waves and the longest of those we call heat. Because of this fact, two distinct methods of attack were used. The first and probably the simplest, involves the absorption of these waves by a screen having such a surface as to give absolutely no reflection. The energy of waves striking the screen would be absorbed and converted into heat. The resulting heat would be detected by sensitive thermocouples. This method was used without success. Had radiations been detected, there would have been no means of calculating the wave-lengths received.

The second method which suggests itself is that in which radio wave-lengths are, by successive modulation processes, converted into wave-lengths of the usual magnitude. This latter method has shown the greatest promise in the investigations which have been carried on. In brief the method of operation amounts to this:

An oscillator of very special design is placed in the immediate proximity of the insects the radiations of which are to be measured. The natural frequency of the

(*Continued on page 757*)



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Stand By!—Broadcast from H. Gernsback

GOOD evening, Fellows! I come before you tonight to unburden myself of a few things that have been troubling me of late.

The other night, at one of these high-brow gatherings at a famous New York hotel, there were present among others four or five radio bugs of the real dyed-in-the-wool variety. There were also present a number of other greater or lesser lights,—and after an enjoyable dinner, we settled down to an informal talk, and discussed all sorts of things. You know the usual after-dinner talk, when a number of good fellows meet and discuss everything from the latest scandal down to the Einstein theory. We all had a bully time, and enjoyed the evening tremendously. So did I.

After a while, being that the company was more or less scientifically inclined, each of the members present talked about his particular endeavor. Dr. De K., an eminent surgeon in his profession, after his little spiel suddenly branched out into astronomy, in which he seemed exceptionally well versed, astounding as it may seem for a surgeon. Mr. L., a well-known painter, entertained us with modern magic, giving an exposé of the latest tricks of the magical trade from Hermann down to Houdini. Mr. MacM., a Wall Street broker, whom one did not suspect of knowing anything more exciting than margins, and bulls and bears, surprised us by his wonderful conception of the Einstein theory, and the latest proofs that have now made the famous theory acceptable to most scientists. Mr. P., who makes his living by selling high-priced automobiles, then sprung the atomic theory on us and took the wind out of most of his hearers. A magnetic talker, he took us into the realms of the atom, and drew a vivid picture of the titanic forces locked up in a grain of sand. I was so fascinated with him that I asked him to put his thoughts down on paper for a magazine article, which he graciously consented to do.

Of course, there was nothing wonderful about all this, but the thing that saddened and hurt me mostly, was that the dyed-in-the-wool radio "bugs" who were present stood out prominently by reason of the things they did not know. They talked glibly and fascinatingly about radio, and we sure had a good time about it. We were especially amused by one of the radio amateurs who lectured on "Radio a thousand years hence," but each and every one of these radio bugs was conspicuous by his lack of knowledge of things that were not immediately concerned with radio. On the subject of radio each and everyone was a star of the first magnitude, but that was all.

Now of course I have no fault to find with this, and perhaps it is no concern of mine, but homeward bound I could not but help reflect upon the results of the evening, and it dawned upon me suddenly what I had never realized before, namely, that the average radio man is a very good radio man, but it seems to me he is terribly one-sided. He works with radio, dreams of radio, acts with radio, and comes well nigh eating it.

Now, I know a great many radio amateurs, professional and otherwise, and it is the exception that the present-day radio man is well versed in general science. Of course, he has a smattering knowledge of science in general, but as a rule it is poor.

I have probably employed in the course of my business career as many radio men, professionals and amateurs, as anyone, but it has always been brought home to me that the radio man is fearfully one-sided. Even such an essential subject as electricity is none too well understood by him. I have been forced time and again to relinquish the services of men, although good radio men, due chiefly to their lack of knowledge of science in general. I do not say that this is the case with all of them, but you will admit that there is a high percentage of them who fall into this category. At the same time, I admit a *thorough* knowledge of radio is not a thing to be sneezed at, but after all, radio is a part of science, and there certainly is no good reason why a radio man should not have a good knowledge of chemistry, astronomy, physics, etc. I have often found that the average radio workers would be a vastly superior man once he embraced general science; for it must be appreciated that radio and science go hand in hand, and that very often great achievements are accomplished by the radio man if he has a good knowledge of general science as well.

Take any of the great radio experts who have invented worth-while things, such as Marconi, De Forest, Fleming, Armstrong, Major Squier, etc., etc. All these gentlemen are not only radio experts, but *they are scientific experts as well*—hence their greatness.

It seems to me that the radio fraternity cannot do better than become thoroughly conversant with all of these subjects, simply by reading SCIENCE & INVENTION MAGAZINE constantly. SCIENCE & INVENTION is a complete course in general science, and is written in such a manner that anyone can obtain a thorough knowledge of the latest scientific achievements be they in the realm of electricity, astronomy, radio, chemistry, invention, mechanics, physics, patents, etc., etc.

Every radio man does himself an injustice if he does not read SCIENCE & INVENTION steadily. Buy a copy on your way home tonight or the first thing in the morning. It can be had at any newsstand. After it becomes a habit, you will wonder how you ever did without it. And, oh, yes! before I forget, *there is now an 8-page radio section in* SCIENCE & INVENTION that you should not miss because it gives you exclusive articles that do not appear in RADIO NEWS, or for that matter in any other magazine.

And then, too, SCIENCE & INVENTION gives monthly prizes. This means money to you. Take for instance the February issue now on the newsstands, contains no less than $500.00 in prizes as follows:

The big $300 prize contest for the "Simplest Radiophone Receiving Set." $23 in prizes for "Scientific Humor."

$100 prize contest for "Practical Uses for Old Bottles." $50 for "Motor Hints." $30 for "How To Make It" articles. $5 for the best "Wrinkle, Recipe or Formula."

Here is a chance for the wide-awake radio "bug" to cash in on some easy money.

Well, fellows, this will be about all for today. More perhaps in the near future. Good night! H. GERNSBACK.

(*Advt.*)

The adjoining photograph shows Mr. H. Gernsback in the act of delivering his lecture: "The Past and Future of Radio," by radio from WJZ, the Westinghouse broadcasting station at Newark, New Jersey. This lecture was given by Mr. Gernsback some time ago, and for those that are interested in it, they will find a complete account in the January, 1922, issue of SCIENCE AND INVENTION, page 842.

Many novel points were brought out by him in that lecture. Mr. Gernsback predicted that very shortly every house would have a sort of "radiotrola", with which everyone could listen in to all sorts of radio concerts, lectures, etc.

In the March issue of SCIENCE AND INVENTION there will be a complete artcle on "How to Build a Radiotrola", with all the details given. You should not miss that issue.

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5 ins.	5 ins.	3/16 in.	6 oz.	.66
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10 ins.	10 ins.	3/16 in.	1½ lbs.	2.62
15 ins.	10 ins.	3/16 in.	2½ lbs.	3.93
5 ins.	7½ ins.	3/16 in.	½ lb.	.99
10 ins.	7½ ins.	3/16 in.	1 lb.	1.97
15 ins.	7½ ins.	3/16 in.	1½ lbs.	2.97
20 ins.	7½ ins.	3/16 in.	2 lbs.	3.74
5 ins.	2½ ins.	⅛ in.	2 oz.	.24
10 ins.	2½ ins.	⅛ in.	4 oz.	.45

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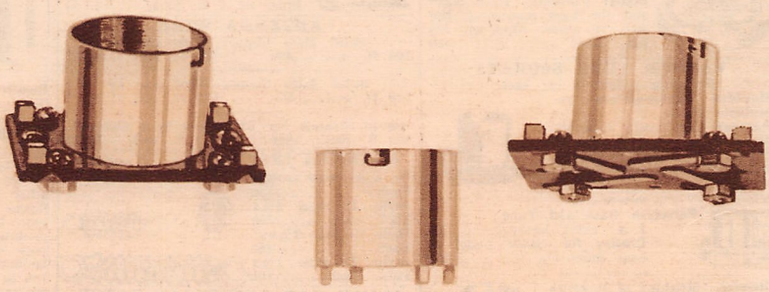
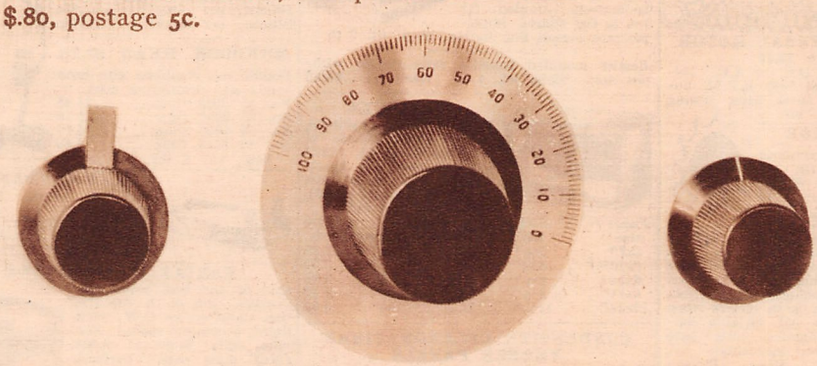


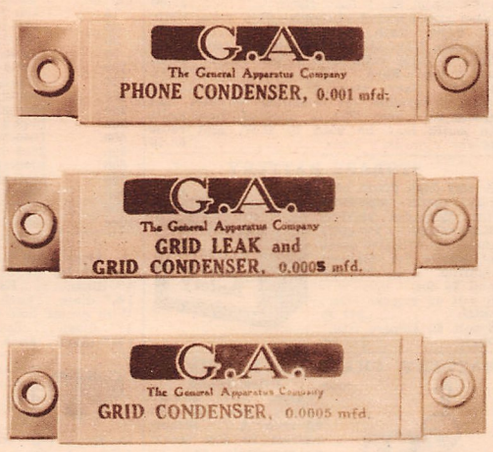


THE G. A. is the only company making a complete set of symetrically designed knobs to cover all requirements —A solid German silver, 3 in., self-shielding dial, a locked-lever switch, and indicating rheostat knob. Prices: 100 or 50° dial and knob, 3/16 or ¼-in. shaft hole, **$1.25,** postage **5c.** Switch, **$.65,** postage **5c.** Rheostat knob, 3/16 or ¼-in. hole. **$.40,** postage **3c.**

ALL over the world G.A. grid, phone and gridleak condensers are in service, doing their work as dependently and consistently as types that sell at four times the price. They are accurate as to capacity and resistance, easy to mount, and as useful on low voltage tube transmitters as on receiving sets, for each one is tested on 220 volts.

When you buy these condensers, however, make sure that they have the G.A. name on the front or back, for the G.A. Company has the exclusive right to manufacture this type. Condensers bearing labels of the J. H. Bunnell Company, Radisco, Dreyfuss, Stanley and Patterson, and Radio Shop of Newark are also made under the G.A. Company's license. All others should be refused as imitations infringing on U. S. Patent 1,395,931, dated November 1, 1921.

Prices: Grid Condenser, **$.35,** Phone Condenser **$.35,** Grid Leak Condenser, **$.50,** postage **3c.**



STANDARDIZED
The General Apparatus Company

570 West 184th Street New York City

Represented in every city of the United States and Canada where experimental radio work is being done.

Send ten cents in stamps for the new G. A. Catalog

SAVE MONEY ON YOUR RADIO SUPPLIES

STANDARD GOODS AT LOW PRICES
FAST SERVICE—TRY US AND BE CONVINCED

THIS GUARANTEE PROTECTS YOU—Examine the goods we ship you. They must suit you in every respect. If you are not satisfied with your purchase return the goods at once and we will refund the price you paid.

VACUUM TUBES

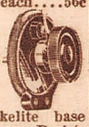
Standard brands — **Cunningham, Radiotron, A. P. Moorhead.** Specify which is wanted. Every one guaranteed new and perfect. ship. wt. 1 lb.

Detector, each $4.45
Amplifier, each 6.10
5 Watt Transmitter, each... 7.25
Rectifier, each 6.95

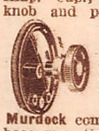
FILAMENT CONTROL RHEOSTATS

Shipping Weight 6 oz. each

Crosley—Wound on vulcanized fiber. Adjustable to any panel. Complete with knob, each....56c

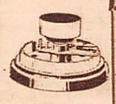


Remler No. 310 Bakelite base 2" diam.—4 ohms resistance, 1½ Amp. Cap., complete with 1⅜" knob and pointer.....92c



Remler No. 813 Bakelite base 2¾" diam. Cap. 3 amp. Resist. 6 ohms, complete with 1⅜" knob and pointer, each $1.58

Murdock combination panel and base mounting Rheostat. Bakelite base. Resist. 6 ohms. Complete with knob, pointer and engraved metal dial.....93c



Paragon combination panel and base mounting rheostat. Moulded condensite base and knob. Capacity 1½ amp. Resist. 6 ohms $1.37

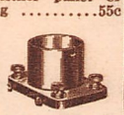
Signal Porcelain Base rheostat for base mounting. Resist. 10 ohms. Ship wt. 1½ lbs. Each 84c

VACUUM TUBE SOCKETS

Shipping weight 6 oz. each.

Moulded Bases—brass receptacle tubes.
Paragon Condensite base 89c
Murdock moulded base.. 95c
Signal sheet formica base, four binding post connections $1.26

Porcelain Base and Tube
J. K. extra heavy.....55c
Crosley for either panel or base mounting 55c



Remler. Moulded of Bakelite suitable for panel or base mounting. Four binding post connections $1.35
Paragon combination type. $1.12

VARIABLE GRID LEAK

Pencil mark type. Resistance may be varied exactly as needed 55c

GRID CONDENSER

Remler—Cap. .00025 M.F. 32c
Signal Mica Insulated, unmounted 25c

"B" BATTERIES

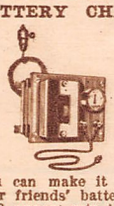
Specially made for radio work. Absolutely uniform. Extra long life. We guarantee these batteries to equal any on the market regardless of price. Large Signal Corp type, size 5x3x2¼, 15 cells—22½ volts. Ship. wt. 2 lbs. Each.....$1.00
Navy size 6½x4x3—15 cells—22½ volts. Ship. wt. 5 lb. Each.....$1.60
Variable Navy size. 9 taps giving range from 10½ to 22½ volts in 1½ volt steps. Ship. wt. 5 lbs. Each.....$2.10
Double Navy size 6½x4x6—30 cells—45 volts. Suitable for amplifier circuits and power tube use. Two or more of these units in series may be used in C.W. and radio phone circuits. Each.....$3.20

STORAGE BATTERY

A very high grade battery made especially for Radio service. Guaranteed. Properly cared for will give years of service for filament lighting. Ship. wts. 20 and 30 lbs.
6 volt 45 ampere size, each.....$11.95
6 volt 80 ampere size, each.....$13.95

BATTERY CHARGING RECTIFIER

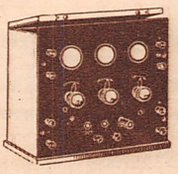
Price $14.50



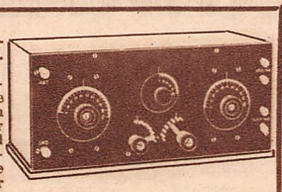
Charges your storage battery from 110 volt 60 cycle A.C. Simply connect to any socket or receptacle, turn on current and rectifier does the rest. Inexpensive to operate, costs but a few cents to charge largest battery. You can make it pay for itself by charging your friends' batteries at low prices. Charges at 8 ampere rate tapering down to 5 amperes. Needs no watching. Can't hurt battery. Self-polarizing. Approved by underwriters. Ship. wt. 15 lbs. Price.....$14.50

If Goods Are to Go Parcel Post be Sure to Include Postage.

SPECIAL OFFER



Regenerative Tuner and Detector Two Step Amplifier. **The two for $62.00.**
This is a combination unequalled for long distance wave receiving. Signals can be brought in clearly over long distance. With a good aerial the range is only limited by the power of the transmitting set. Send for complete descriptive circular.



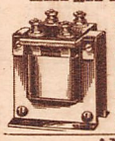
DETECTOR-TWO-STEP AMPLIFIER, PRICE $31.00

A very sensitive instrument. Signals that cannot be heard with detector alone will be brought in strong. Has one detector and two amplifying circuits. Standard tube sockets, grid condenser in detector circuit, two amplifying transformers, 3 jacks and a plug. Satin finished Formica Panel. Fine Mahogany finish large size cabinet. Hinged top. Interior easily accessible. Binding posts for all necessary connections.

REGENERATIVE TUNER, PRICE $34.50

This is a standard make Armstrong licensed set. Guaranteed first class. Range from 180 to 600 meters. Will tune sharply and bring in signals strong even under difficult conditions. Fine Mahogany finished large size cabinet. Satin finished formica panel. Two high grade variometers, with variocupler for closest tuning. Engraved dials, knobs, switches, binding posts for all necessary connections etc. An outfit regularly sold for $45.00. Very selective.

AMPLIFYING TRANSFORMER



An especially high grade transformer with correct characteristics for Cunningham, Radiotron or A.P. Tubes. Wonderful results without distortion on one, two or three steps. Low distributed capacity. Fully mounted on bakelite panel. Ship. wt. 1 lb. Each.....$3.55

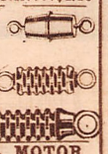
ANTENNA WIRE

Solid Bare Copper Wire size 14
100 ft. coil....40c 500 ft. coil....$1.78

Solid Bare Copper Wire size 12
100 ft. coil....65c 500 ft. coil....$2.70

Seven Strands No. 22 Copper Wire Cabeled
100 ft. coil....88c 500 ft. coil....$4.10

ANTENNA INSULATORS



Style A—Size 2¾x1¾" Each 19c
Style B—Size 2½x3¾". each.....30c
Style C—Size 1½x4" Each 45c
Style D—Size 1½x10½. Each.....70c

SPARK GAP UNIVERSAL MOTOR

Each $8.75

Runs on either D.C. or A.C. 100-125 volts. Speed 5000 R.P.M. under load. For spark gaps, sewing machines, fans, etc.

SPARK GAP ROTOR

Bakelite center disc, aluminum teeth, shaft bushing with set screw. Diam. 5⅝ inches. While they last 1.85

INDUCTANCE COILS

Carefully made—fine looking coils. Highest efficiency. Low distributed capacity effect, low resistance—high self inductance. Very firm enamel impegnation. Range given is in meters when varied with .001 variable condenser. Mounted coils have standard plug mountings.

Turns	Range	Price Unmounted	Price Mounted
25	120-250	35c	$1.25
35	175-450	40c	1.30
50	240-720	45c	1.33
75	390-910	53c	1.35
100	500-1450	56c	1.38
150	600-2000	60c	1.42
200	900-2500	64c	1.46
250	1200-3550	68c	1.50
300	1500-4500	72c	1.60
400	2000-5000	76c	1.65
500	2800-6100	80c	1.80
600	4000-10000	88c	1.98
750	5000-12000	$1.08	2.20
1000	7900-15000	1.32	2.35
1250	9750-19500	1.60	2.70
1500	14500-26500	1.95	3.15

INSULATE KNOBS

A—Army and Navy Type Knob, bushed for 10/32 thread.
1" diam.....Each 9c..Doz. 98c
1⅜" diam...Each 13c..Doz. $1.45
With center hole to take ⅜" rod.
1" diam.....Each 8c..Doz. 85c
1⅜" diam...Each 13c..Doz. $1.40

B—Marconi Knob. 3/16" hole at bottom tapers to 7/16" at top. 1¼ diam. Each 12c..Dozen....$1.15
2⅜" diam...Each 21c..Doz. $2.25

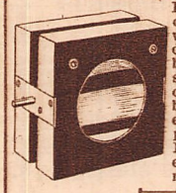
C—Knob 1⅝" diam. drilled for 3/16 rod with set screw.
Each 20c.....Dozen $2.20

SWITCH CONTACT POINTS

Brass, polished nickel finish. All have ⅝" long size 6/32 screws.
With head ¼ x ¼" and two nuts, per dozen.....45c
With head ⅛ high 3/16 diam. and two nuts, per dozen...45c

With head ¼ x ¼ and soldering lug, per dozen 38
With head ⅛ high 3/16 diam. and soldering lug, per doz. 38c

VARIOMETER, EACH $3.95



Perfect in design and construction. Accurate wood forms. Correct induction ratios. Solid baked windings. Positive soldered cable circuit contacts. No friction bearing contacts. Highest efficiency. Will operate perfectly indefinitely. Make your own regenerative set and save money. Ship. wt. 2 lbs.

Remler moulded bakelite Variometer, without dial. Ship. wt. 4 lb. Each.....$5.70

VARIO-COUPLER, EACH $3.35

With this loose coupler and two variometers together with the necessary other parts a highly efficient regenerative set can be made. Easily mounted on panel. Windings on formica tubes. Inductively coupled for 180 to 600 meters. Multiple taps permit fine tuning. Ship. wt. 2 lb.

Remler moulded bakelite vario-coupler without dial. Ship. wt. 4 lb. Each.....$5.15

CABINETS

Fine looking cabinets, solidly built. Made of seasoned wood in waxed antique mahogany finish. Hinged tops. Front rabbeted to take panels. Panels not included.

Panel size	Inside Dimensions High	Wide	Deep	Price each
6x7"	5½"	6½"	7"	$2.25
6x10½"	5½"	10"	7"	2.55
6x14"	5½"	13½"	7"	2.95
9x14"	8½"	13½"	10"	3.35
12x14"	11½"	13½"	10"	3.95

CONDENSITE CELERON FIBRE VENEER PANELS

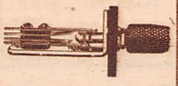
Notice our very low prices. Very fine quality. Made of Veneered Condensite Celeron (a product with chemical and electrical properties very similar to formica and bakelite). Two outside sheets of condensite celeron are super imposed upon an inner base of fiber to form an absolutely permanent perfect unit. Machines better than any other similar product. Won't warp. High mechanical and dielectric strength. Attractive natural polished finish which can be sanded and oiled for extra fine work. Black color.

Panel size inches	Price ⅛" Thick	Price 3/16" thick	Price ¼" thick
6x 7	$0.45	$0.56	$0.72
6x10½	.67	.84	1.08
6x14	.90	1.12	1.44
9x14	1.35	1.68	2.16
12x14	1.80	2.24	2.88
14x24	3.60	4.48	5.76

BINDING POSTS

Brass, polished nickel finish. Washer and 6/32" screw extending 5/8". Large size—barrel and knob ¾" long. Each 12c; Dozen $1.25.
Smaller size—barrel and knob 9/16" long. Each 9c. Dozen 98c.
Medium size with composition knob Each 9c. Dozen $1.10.

RADIO JACKS AND PLUGS

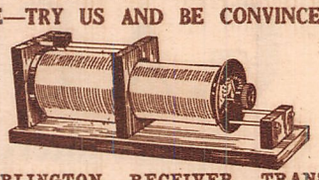


Jacks are polished nickel finish. Mount on panels ⅛ to ¼ in. thick. Extend back of panel only 2 7/16 in. Silver contact points.

Jacks Only
Open circuit, each.....59c
Closed circuit, each.....69c
Two circuit, each.....79c
Single circuit filament control...92c
Two circuit filament control...$1.15

Plug. Large space with set screws for attaching cord. Each.....94c

ARLINGTON RECEIVER TRANSFORMER

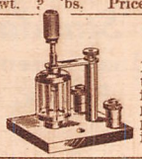


Tunes in all government time stations. Works up to 1,000 meters. Handles short waves in fine shape. Silk covered windings on formica tubes. High grade mahogany finished woodwork. Slider controls primary. 10 point switch secondary. Can be tuned very close. A wonderful value at our price.....$6.85

TUNING COIL

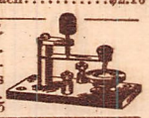
Range up to 950 meters. Wound with bare copper wire. Ends of mahogany finished hard wood. Two easy sliding contacts on polished brass rods, four binding posts. Substantial, efficient, attractive. Length 8¾ inches. Ship. wt. 2 lbs. Price.....$3.15

ENCLOSED DETECTOR



Bakelite base. Supersensative galena crystal enclosed in heavy glass shield. Quick positive adjustment. Brass parts polished nickel finish. Each.....$2.10

GALENA DETECTOR



Easy fine adjustment. Crystal mounted in cup. Moulded base and knob. Brass parts polished nickel finish. Each $1.35

TEST BUZZER

Test your detector circuit and be sure of your signals. Nickel plated watch case buzzer. Shipping wt. 4 oz. Each.....88c

Mesco or **Century** Radio tone buzzer. Each $2.15
Buzzer push button fits ⅝" hole. Each 25c

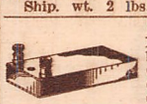
DETECTOR CRYSTALS

Carefully tested
Galena, per piece.....20c
Silicon, per piece.....20c

MURDOCK HEAD SETS

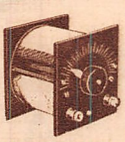
Double sets complete with head bands and connecting cord.
No. 55 2000 Ohm.....$4.25
No. 55 3000 Ohm..... 5.10
No. 56 2000 Ohm..... 4.70
No. 56 3000 Ohm..... 5.60
Ship. wt. 2 lbs. per set.

FIXED CONDENSERS



Moulded cases, nickeled binding posts.
Capacity .0003 Mfd. Ea. 68c
Capacity .0007 Mfd. Ea. 82c
Capacity .01 Mfd. Each 65c

VARIABLE CONDENSER



One of the best made condensers. One of the few that will stand up on C.W. work. Rigid, accurately spaced. Formica ends. Engraved Scale. Clear glass case. Perfectly set aluminum plates.
43 plate .001 Mfd.....$4.60
21 plate .0005 Mfd..... 3.70

PANEL MOUNTING TYPE

With Knob and Scale
Same high grade as above for panel mounting.
43 plate .001 Mfd...$4.30
21 plate .0005 Mfd... 3.45
11 plate .00025 Mfd. 3.10
Without Knob and Scale Deduct 20c

KNOCKED DOWN VARIABLE CONDENSERS

You can save money by assembling your own condensers. Formica top and base, scale, pointer, and knob. Complete not assembled.
41 Plate .001 Mfd. $2.95
21 Plate .0005 Mfd. 1.95

SWITCH LEVERS

A. One inch radius, polished nickel finish. Fitted with coil spring, terminal and two nuts. Each 39c
B. Same but with Remler bakelite knob. Each.....54c
C. Same as A but with bushing bearing, panel, nut and soldering lug. Each.....48c

Switch Lever Stop. Brass, nickel plated. Matches our Switch contact points. 2 for 9c. Per dozen.....50c

DIALS AND KNOBS

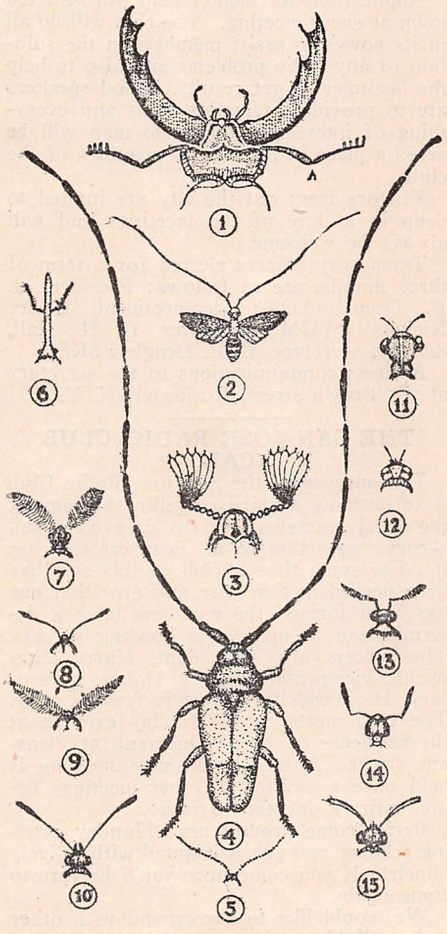
3 inch Bakelite Dial and Bakelite Knob as illustrated, complete, each 60c
Dial only, each 40c
Knob only, each 20c
Remler Bakelite Dial with knob and bushing. Specify 3/16 or ¼" shaft, each.89c

THE BARAWIK CO. 26 N. Desplaines Street, CHICAGO, ILL.

oscillator is varied from time to time to cover a fairly wide range in frequencies. The minute powers that are made available from this oscillator are allowed to react upon a radio generator producing more usual frequencies and these in turn are allowed to react on a second radio-frequency generator of easily amplified frequencies. The resultant oscillations are rectified and amplified again by the ordinary low-frequency amplification methods.

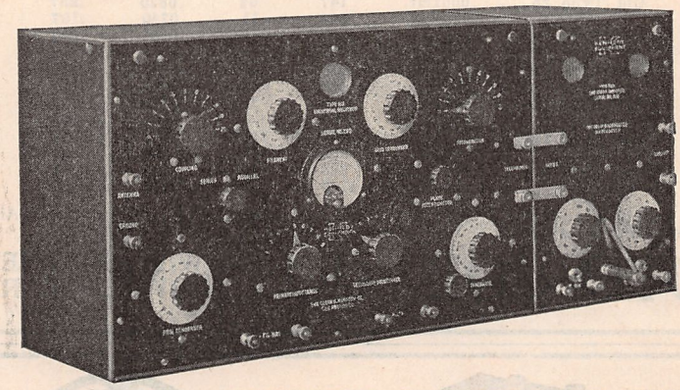
This latter method, because of its easily calculable quantitative values throughout the system and because of the segregation of the several steps that go to make the detection of the radiations possible, and its observance by either audible or visible methods are possible, offers the greatest promise. Ultimately it will undoubtedly result in sufficient information to guide experimentation which will be done by methods other than those outlined here.

In connection with this work it is interesting to know that the detector originally used by Hertz in his classical experiments on electromagnetic wave propagation and reception bears a marked resemblance to the antenna carried by a moth. In fact, Hertz called the device an antenna because of this fact. In watching a moth, it will be observed that the insect uses its antenna in the most uncanny fashion. It will turn itself about, turning the antenna first in this direction and then in that. The action reminds one of the movements necessary to bring a compass station antenna into the proper relationship with an oncoming wave. This brings up the question do wireless waves give the moth a sense of direction? In flying to the female moth,



Some of the Insects Carrying Antennae Which They May Use for Communication by Wireless.
(1) Stag Beetle, (2) Long-horned Moth, (3) Cockchafer, (4) Timberman Beetle, (5) Cockroach, (6) Nut Weevil, (7) Mosquito, (8) Female Emperor Moth, (9) Male Emperor Moth, (10) Butteruy, (11) Dragon-fly, (12) House Fly, (13) Honey-Bee, (14) Garden Ant, (15) Common Wasp.

A Real Quality Combination
Effective Reception
On All Wave Lengths
From 175 to 25,000 Meters



KENNEDY TYPE 110 UNIVERSAL REGENERATIVE RECEIVER WITH TYPE 525 TWO STAGE AMPLIFIER

All Kennedy regenerative receivers are licensed under Armstrong U. S. Patent No. 1,113,149.

For those who want radio reception with amplification over a broad range of wave lengths, this combination is unsurpassed.

The Kennedy Type 110 Universal Regenerative Receiver is all that its name implies. It affords convenient means of tuning from 175 to 25,000 meters with highly efficient reception over that entire range.

In many installations where this receiver is in use, it is accompanied by our Type 525 Two-stage amplifier as illustrated here. This amplifier matches the Type 110 receiver in height, depth and general finish, and, being built according to the high Kennedy standard is a worthy companion for it.

Send for Bulletins 101 and 501 describing these units

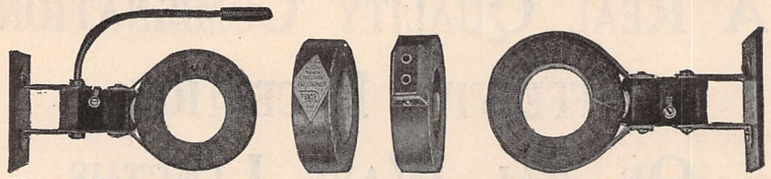
THE COLIN B. KENNEDY COMPANY
INCORPORATED
RIALTO BUILDING SAN FRANCISCO

Largest Stock *of* Radio Supplies in U. S. A.

Catalog No. 5 is ready. Mail orders filled same day received. Formica panels cut size wanted, 1/8—2c. per sq. inch, 3/16—3c. per sq. inch, 1/4—4c. per sq. inch.

DETROIT ELECTRIC CO.
434 SHELBY STREET DETROIT, MICHIGAN

READY FOR DISTRIBUTION



We are pleased to announce that our new short-wave coils are ready for distribution. They are not "freak" coils but designed upon the solid fundamentals of radio practice. They are, however, adapted for use with our standard unit mounting fixtures. With a given condenser these coils all have a greater wave-length range, than the honeycomb coils.

But most important—note the H.F. resistance values and decrement of three of the secondary coils compared with three old type honeycombs.

	External Capacity	Wave-Length	H.F. Resist.	Power Factor	Decrement
Old Type 25....	.0001mf.	147	64	.0820	.257
	.0004mf.	244	11	.0340	.107
New Type 1s....	.0001mf.	147	12	.0154	.048
	.0004mf.	273	3	.0083	.026
Old Type 50....	.0001mf.	283	134	.0891	.280
	.0004mf.	475	23	.0364	.114
New Type 2s....	.0001mf.	305	26	.0160	.050
	.0004mf.	588	8	.0102	.032
Old Type 100...	.0001mf.	540	314	.1091	.343
	.0004mf.	900	40	.0334	.105
New Type 3s....	.0001mf.	623	71	.0212	.067
	.0004mf.	1160	11	.0072	.022

Facts are facts. We place them before you to *use* when buying inductances. And will furnish more for the asking.

COTO-COIL CO. 87 WILLARD AVENUE PROVIDENCE, R. I.

Pat. apd. for

HIPCO

Wireless B Battery

Refillable **Variable**

No. 100—22½ Volts
Size 7 x 4¼ x 2⅝
Price $3.00

No. 140—22½ Volts
Size 4⅜ x 2¾ x 2½
Price $2.00

Refillable and variable B Battery especially designed for Vacuum tube work on plate circuits is guaranteed to be perfectly noiseless, it will give double the life of the ordinary battery.

The above cut shows part of the cover cut away which illustrates the convenience in inserting a new cell should one prove defective. These replacements are furnished complete with a positive and negative terminal soldered fast, and will be sent to any address upon receipt of 25c. They can be inserted without the use of soldering iron if desired.

Sample mailed to any address upon receipt of List price

LIVE JOBBERS AND DEALERS WANTED

HIPWELL MANUFACTURING CO., 825-835 North Ave. N. S. PITTSBURGH, PA.

ANNOUNCING

"The Opening, January 1st, of our RADIO DIVISION, planned to serve the Radio Man as he wants to be served—promptly and efficiently. We carry a complete stock of standard-make parts and apparatus, and assure you that MIDWEST is anxious to demonstrate to you its SERVICE."

Midwest Sales & Supply Co.

RADIO DIVISION

BOX 551 INDIANAPOLIS

Get a Handy Binder for your RADIO NEWS. Holds and preserves twelve issues, each of which can be inserted or removed at will. Price 65c. Experimenter Pub. Co., Inc., Book Dept., 236-A Fulton St., New York.

the male will alight near her and move his antenna about in what appears to be a very systematic manner. After a certain amount of this feeling about, the creature will go to the female in as straight a line as possible.

The present experiments of Mr. Horle have not as yet brought forth any positive results. The problem of manipulating the detecting equipment such as Mr. Horle has assembled, is a difficult one as all amateurs will realize who have tried their luck with several stages of amplification. The values of the various circuits must be adjusted to a certain point and the entire equipment used must be correlated in such a way that it will function smoothly. Although much painstaking work has been done, Mr. Horle has not succeeded in getting a response that could be taken for a "bug" wireless message. He has heard peculiar noises in the 'phones, but he is not sure that these were not caused by local electrical effects. If the moths do use wireless, the wavelengths employed must be a very small fraction of an inch long. The problem of detecting waves of this length is no small one.

Club Gossip

(*Continued from page 721*)

or only a receiving set became a member. In this way the club will become the representative organization and also give every member a voice in the making of any regulations that may be necessary to govern local traffic.

The meetings of the club will be held at Central Y. M. C. A. every Monday evening at eight P. M.

Applications for membership will be acted upon at every meeting. The club will do all in its power to assist members in the solution of any radio problems and also to help the beginner to get results. Good speakers are to provide interesting talks and everything of interest to the radio man will be given a place in the weekly meetings of the club.

Visitors from out the city are invited to drop in at any of the meetings and will always be welcome.

Temporary officers elected for a term of three months are as follows: President, J. R. Dean, 8ADN; vice-president, C. F. Nichols, 8AMM; treasurer, G. H. Hall, 8ANK; secretary, C. E. Dengler, 8KS.

Address communications to the secretary at 285 Brown street, Rochester, N. Y.

THE SAN JOSE RADIO CLUB (CAL.)

The purpose of the San Jose Radio Club is to promote a spirit of fellowship among the local amateurs and to give code and theory instruction to all members desiring it. For some time a club of this sort has been needed in San Jose and now that one has been formed the members have a determination to make it a howling success. The officers are: President, Harry Engwicht; vice-president, Jack Holmes; secretary, H. Weddell; treasurer, Irwin Coffey. The club meets every Monday evening at the residence of Frank Quement, 51 Pleasant street. A strictly business meeting is held once a month, all other meetings being entirely devoted to radio.

Better come around next Monday evening fellows, and get acquainted with a lively bunch! If you come once you'll be sure to come again.

We would like to correspond with other clubs. Address correspondence to secretary H. Waddell, 31 Grant street, San Jose, Cal.

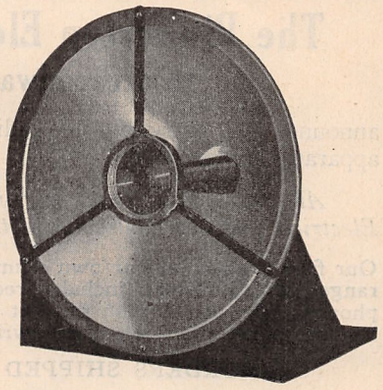
THE AMATEURS OF VANCOUVER ISLAND.

Most of the amateurs on the island live

THE AMPLITRON

PAT. APP. FOR

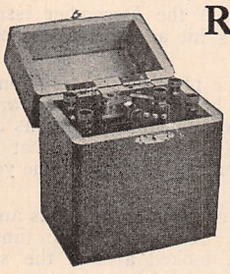
A REAL *LOUD* SPEAKER



The Amplitron is a product of the Radio Service laboratory and has been designed and constructed especially for radio work. It gives surprising results. The Amplitron has been developed to meet the longfelt want for a loud speaker which, at the same time, meets both the requirements of price and efficiency. It reproduces radio phone speech and music without distortion—equally good for code.

No exciting batteries or adjustments necessary.
Uses a Baldwin Type "C" single phone.

THE LITTLE WONDER PORTABLE RADIO RECEIVING SET



The only complete practical radio set now obtainable. Complete, including Type S8 receiver, Murdock 2,000 ohm headset, complete aerial equipment, an 85-page book on the operation of radio apparatus and a blue print of instruction for only ..... **$15.00 Postpaid**

Type S8, receiver only ..... **7.50 Postpaid**

Just what you need to entertain your friends on all occasions

Amplitron less telephone receiver **$10.00**
(use your own Baldwin Type "C")

Amplitron equipped with Baldwin Type "C" phone and cord **$16.25**

For sale by all reliable dealers or direct from us.

Radio Service & Mfg. Co.

Sales Division — 110 West 40th St., New York City

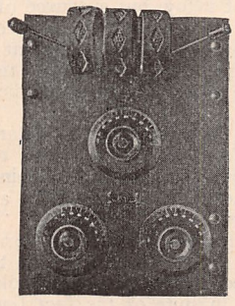
Factory — Lynbrook, L. I.

DUCK'S NEW CATALOG No. 16

275 Pages *A Catalog Deluxe*

Type "Q" Receiver

An Ideal Receiving Set for Long and Short Wave and Radio Telephone Reception.



This set is the most flexible receiving set on the market. With the use of the various sizes of Honeycomb Coils everything in the range of radio telegraph and telephone reception from 200 to 25,000 meters is brought into your home. Consists of a three coil mounting and three Variable Condensers of proper capacity. Tuning extremely sharp. Remler dials.

Price Without Detector

$35.00

Send 12c today (stamps or coin) for copy of the greatest radio catalog ever put between the pages of two covers.

Never in the history of radio has there been such a catalog.

The radio data and diagrams embracing upwards of fifty pages gives the experimenter more valuable and up-to-date information than will be found in many textbooks selling for $2.00, and $1.00 could be spent for a dozen different radio catalogs before you could gather together the comprehensive listing of worth while radio goods found in this great catalog.

A brief summary of the radio goods listed in this catalog:

The entire radio catalog of the Radio Corporation, with a wealth of scientific and technical data on C.W. transmitting sets, and all the diagrams for the assembling of these sets; the complete Remler catalog, which embraces 25 pages, the Westinghouse, Firth, Murdock, Federal, DeForest, Clapp-Eastham, Brandes, Connecticut Company, Thordarson, Turney, Magnavox Company catalogs, the best products of Adams-Morgan, Signal and countless other manufacturers, including our own complete line of radio apparatus, and many individual items and parts used in radio work today.

DEALERS

We want live responsible dealers in every city and town in the United States, both for the sale of our extensive line of radio apparatus and all other worth while lines of radio goods on all of which we can quote attractive dealers discounts. We can offer you facilities and advantages that no other radio house can offer.

Send only 12c for copy of this wonderful catalog. You will need no other when you have Duck's, and you cannot find in all others combined what you will find in Duck's Wonder Catalog.

THE WILLIAM B. DUCK CO., 231-233 Superior St., Toledo, Ohio

SPECIAL ANNOUNCEMENT

The Pinkerton Electric Equipment Co.

1834 Broadway, New York City

announce their entry into the Radio Field—with a complete line of Radio apparatus and supplies.

All our Radio Goods carry our unconditional guarantee against Electrical and Mechanical Defects For One Year.

Our first product of our own manufacture is a complete crystal receiver—range 150-650 meters, includes receiver, aerial and ground materials and phones. We also furnish this set less phones, aerial and ground material. For prices on either set please write or phone.

ORDERS SHIPPED SAME DAY RECEIVED

Dealers—Write for Proposition

PINKERTON ELECTRIC EQUIPMENT CO.

RADIO DEPT.

1834 BROADWAY NEW YORK CITY

Phones Columbus 0611—0434

CONDENSITE

Condensite has been a big factor in improving the quality of radio equipment.

There is scarcely a piece of wireless apparatus made in which Condensite or Condensite-Celoron could not be used to advantage.

The surface and volume resistivity of Condensite-Celoron are extremely high. It has all the properties essential to good electrical insulation.

Make sure that your next radio unit is made of Condensite.

Condensite Company of America
BLOOMFIELD, N. J.

QST AMATEURS, EXPERIMENTERS QST

Our Stock of CW TRANSMITTING and RECEIVING Apparatus Now Complete

Fada Power Rheostats	$1.35	Type C Baldwin Phones	$12.00
G.R. Hot Wire Meters	7.75	Type E Baldwin Phones	13.00
UV202 5 W. Power Tubes	8.00	Remler Variometers (Less Dials)	6.00
Tuska Inductance (New Type)	4.65	Amrad Variometers (With Dial)	6.75

$1.00 PER COIL 200 FEET Aeroplane Antenna Wire PER COIL 200 FEET $1.00

(COMPOSED 16 STRANDS NO. 30 BARE COPPER) (INCLUDE POSTAGE ON 2 POUNDS)

"THE HOUSE OF SERVICE"

LINZE ELECTRICAL SUPPLY CO.

1129 OLIVE STREET DEPT. N ST. LOUIS, MO.

in Victoria, the capital city of B. C. Receiving conditions are not extra good and often signals from U. S. amateurs and B. C. coast stations fade right out, but the radio concerts from the Pacific coast can all be heard using a single valve and honeycombs. There is very little sending going on, there being only one powerful set and a radiophone (9BE) which transmits music for a few hours three times a week. Most of the hams use Ford coils for sending; there are only one or two who send regularly. A wireless club has been formed and in a few months' time will be equipped with the latest type C.W. sending and receiving sets. A high power spark set may also be used. Victoria hams are going to throw away their crystals and Ford coils when the club gets them interested in up to date radio subjects. Details of the activities of this club will be forthcoming later.

Correspondence from Readers

(*Continued from page 716*)

AS IT SEEMS TO "THE MAN ON THE STREET."

Editor RADIO NEWS:

The editorial in the December issue of the RADIO NEWS hit a responsive chord in my breast.

Yielding to the pleadings of my fourteen year old son, I bought him several articles that had been recommended to me as a fair starter for a Radio outfit—one that could be enlarged from time to time, as the youngster developed.

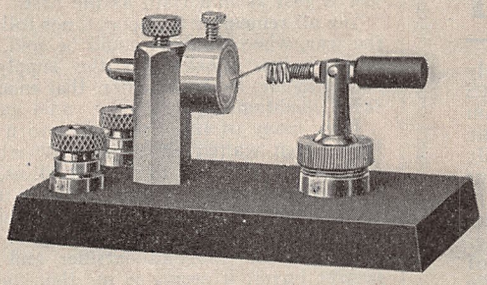
The very act of buying them was an education in itself. I started some time before Christmas, looked around the stores, read all the literature I could secure and bought the current as well as the back numbers of RADIO NEWS.

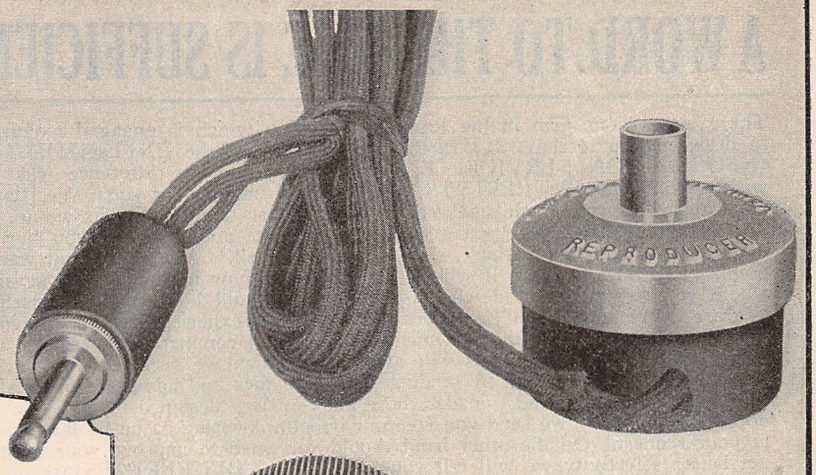
Gradually a faint glimmer of what I was up against drifted through my bewildered mind. Figuring that my education had somehow been neglected, I called in a friend and asked him what was needed. He said, "A loose-coupler, a variable condenser, a fixed condenser and a crystal detector." I bought 'em and the youngster was duly pleased.

Well, to get down to the nub of things, the kid and I got the apparatus up, and, with the assistance of a boy friend, put it in working order. Then the fun began. I found that the Radio outfit we had, while simple, was not a toy, but a source of keen enjoyment to myself and the rest of the family. The only fault was that at times the signals were faint and at other times it was impossible to get a contact on the crystal.

I became so interested that I determined to enlarge the set, so I paid a visit to several radio supply stores in the vicinity of my office. The minute I went into a store I was deluged with "amplifiers," "inductances," and Heaven knows what terms, all Greek to me. When I insisted on talking cause and effect I was generally looked on as a pest, this in spite of the fact I wanted to spend good money with them. In one case a boy waited on me, and when I asked him if a detector panel and a bulb would clarify the signals he started to talk technical terms until I asked him to stop and then he turned me over to the proprietor who, unusual case, took pity on me, and explained what I needed.

How many men have been discouraged by too much technic? Why not get down to "brass tacks" and let the man on the street know in plain, unvarnished English what it is all about—and then a radio (not a wireless) outfit will be in every home, like a phonograph, a piano or the family cat.





MAKE YOUR OWN LOUD TALKER!

NEW Vocaloud phonograph attachment fits tonearm of your Victor or Columbia phonograph or metal horn. This outfit consists of a Vocaloud reproducer, altered in accordance with Firco engineering design, with special moulded cap, six feet of silk covered cord and Firco round type "Bull-Dog-Grip" Plug, complete for $14.00.

FIRCO Rheostat. Mount the Firco resistor and the Firco Type 7-A switch on your panel and you have a professional type Rheostat, 100% air cooled and closely variable. Switch 90c, Resistor, 50c. Both together, $1.30.

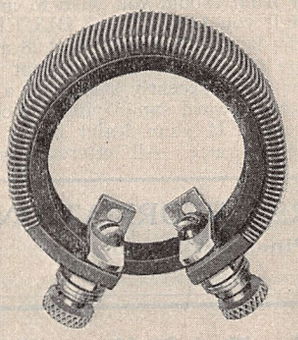
HERE is the Crystal Detector exactly as used on the Kolster Decremeter. The most easily adjusted detector ever designed. Satisfaction guaranteed in direct comparison with any other type of Crystal Detector. Price $2.50. Silicon Crystal, 25c. Supersensitive Galena Crystal, 40c. Both mounted in Woods' Metal.

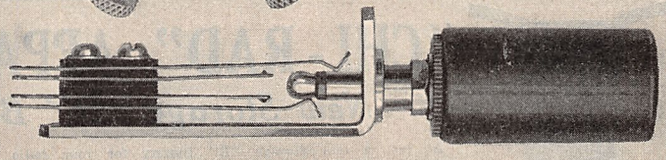
FIRCO Jacks and Plugs. "Bull-Dog-Grip" interchangeable telephone plugs. Flat type, 34A, $2.00, round type, 34B, $2.50. Firco Jacks, 99% sterling silver contacts. Nickel silver instead of phosphor bronze springs. Open circuit 70c, Closed circuit 85c. Double circuit $1.00. 3 spring automatic filament control Jack, $1.15.. 5 spring automatic filament control Jack, $1.40.

Examine Firco Products at all leading radio dealers

JOHN FIRTH & CO., Inc. 18 Broadway, New York

Ask your dealer to show you the new Firco-Clad transformer. Slightly larger than the Saco-Clad. Ratio 1:9. **Price $7.00**
Also the new improved Saco-Clad audio frequency transformer. Ratio 1:8. . . . . . **Price $6.00**





RADIO CORPORATION PRODUCTS

We are distributors and jobbers for the Radio Corporation of America and always carry a complete stock of their apparatus. We list below their complete line and in addition can supply you with the Radio Corporation C.W. instruction book at 25c per copy.

Item		List Price
	VACUUM TUBES	
1	Radiotron (detector) UV—200	$5.00
2	Radiotron (amplifier) UV—201	6.50
3	Radiotron (5-watt) UV—202	8.00
4	Radiotron (50-watt) UV—203	30.00
5	Radiotron (250-watt) UV—204	110.00
	POWER TRANSFORMERS FOR C.W. SETS	
12	325-watt, UP—1368	25.00
13	750-watt, UP—1016	38.50
	A—Filament heating Transformer for UV—204, UP—1633	.....
	B—Power Transformer for UV—204, UP—1636	.....
	C.W. ACCESSORIES	
14	Oscillation Transformer UL—1008	11.00
15	Magnetic Modulator (½ to 1½ amp.) UT—1643	9.50
16	Magnetic Modulator (1½ to 3½ amp.) UT—1357	12.00
17	Magnetic Modulator (3½ to 5 amp.) UT—1367	17.00
18	Filter Reactor (160 milliamp) UP—1626	11.50
19	Filter Reactor (300 milliamp) UP—1627	15.75
20	Plate Circuit Reactor, UP—415	5.75
21	Filter Condenser ½ mfd.—750 V., UC—1631	1.35
22	Filter Condenser, 1 mfd.—750 V., UC—1632	1.85
23	Filter Condenser, ½ mfd.—1750 V., UC—1634	1.50
24	Filter Condenser 1 mfd.—1750 V., UC—1635	2.00
25	Transmitter Grid Leak (5-watt tubes), 5000 ohms, UP—1719	1.10
26	Transmitter Grid Leak (50 and 250-watt tubes), 5000 ohms, UP—1718	1.65
27	Antenna Ammeter, 0-2.5 amp., UM—530	6.00
28	Antenna Ammeter, 0-5 amp., UM—533	6.25
29	Sending Key UQ—809	3.00
30	Microphone Transformer UP—414	7.25
31	Filament Rheostat (for UV—200, 201 and 202) PR—535	3.00
32	Filament Rheostat (for UV—203 and 204) PT—537	10.00
33	Rotary Grid Chopper PX—1638	7.25
34	Shaft Bushings for ¼" or 5/16" motor shaft	.20

Item		List Price
	KENOTRON RECTIFIERS	
6	20-watt Kenotron, UV—216	7.50
7	150-watt Kenotron, UV—217	26.50
	VACUUM TUBE SOCKETS	
8	Porcelain Socket (for UV—200, 201, 202, 216) UR—542	1.00
9	Porcelain Socket (for UV—203 and UV—217) UT—541	2.50
10	Bakelite Socket (for UV—200, 201, 202, 216) UP—552	1.50
11	Mountings (250-watt tube) UT—501, UT—502	2.00
	SPECIAL CONDENSERS FOR C.W. SETS	
35	Antenna Series Condenser, 7500 V. .0003, .0004, 0005 mfd., UC—1015	5.40
36	Plate and Grid Condenser—3000 V. .002 mfd., UC—1014	2.00
37	Special Condenser—10,000 V. .000025 mfd., UC—1803	5.00
38	Special Condenser—.002 mfd., 6000 V., UC—1806	7.00
	VACUUM TUBE DETECTOR ACCESSORIES	
39	Intervalve Amplifying Transformer, UV—712	7.00
40	Special "A" Battery Potentiometer, PR—536	2.00
41	Tubular Grid and Plate Condenser	
	.00025 mfd. UC—567	1.20
	.0005 " UC—568	1.35
	.001 " UC—569	1.50
	.0025 " UC—570	2.00
42	Grid Leaks	
	UP—509, .05 megohm / UP—518, .75 megohm	
	UP—510, .1 " / UP—519, 1.0 "	
	UP—511, .15 " / UP—520, 1.25 "	
	UP—512, .20 " / UP—521, 1.5 "	
	UP—513, .25 " / UP—522, 1.75 "	
	UP—514, .30 " / UP—523, 2.00 "	
	UP—515, .40 " / UP—524, 2.50 "	
	UP—516, .50 " / UP—525, 3.00 "	
	UP—517, .60 " / UP—526, 4.00 "	
	UP—527, 5.00 "	$ .75 ea.
43	Grid Leak Mounting UX—543	.50

CUT PRICES ON OVER-STOCK OF OTHER EQUIPMENT

	List Price	Our Price
Acme F-1 fully-mounted 1 K.W. transformer with choke coil	$45.00	$35.00
Acme H-1 fully-mounted ½ K.W. transformer with choke coil	30.00	22.50
Acme 500 fully-mounted ½ K.W. transformer without choke coil	22.00	17.50
Acme 250 unmounted ¼ K.W. transformer without choke coil	13.00	10.00
Mesco 1 K.W. keys with ¼ inch silver contacts	4.00	2.75
Tuska C.W. inductance Type 181A	5.00	4.00
L-104 Regenerative receiving transformer (loose-coupler)	29.50	20.65
L-103 Regenerative receiving transformer (loose-coupler)	23.50	16.45
L-102 "Standard" receiving transformer (loose-coupler)	19.50	13.65
121 Single capacity fixed phone condenser .005 M.F.	1.50	.80
122 Double capacity fixed phone condenser .005 M.F.	1.80	1.00
123 Double capacity fixed phone condenser .005 M.F. with switch	2.50	1.40
De Forest CV-500 condensers—ideal for C.W. work; .0005 M.F.	5.25	4.50
No. 115 Crystal detector complete with galena and cats-whisker	1.60	1.00
No. 117 Crystal detector complete with galena or silicon	2.15	1.50
No. 110 Crystal detector complete with galena or silicon	2.10	1.45

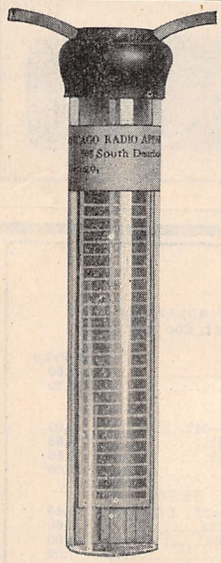
Send 15c for our complete literature

ELECTRICAL SPECIALTY COMPANY, 48-50 South Front Street COLUMBUS, OHIO

A WORD TO THE WISE IS SUFFICIENT

There is only one firm in the Radio field to-day which is engaged exclusively in designing up to date BLUEPRINTS and this is the EXPERIMENTERS INFORMATION SERVICE (E. I. S.). It makes no difference what you wish to build, our BLUEPRINTS are ready and waiting for you. We stipulate what apparatus you should use, regardless of whose manufacture as we are only satisfied in knowing that you get the best results and not that you buy our manufactured goods of which we have none to sell. What is it you want to build, let us tell you what it will cost and suggest how it should be gone about, where you should buy and what you should pay and how you will assemble. We are competent Radio Engineers with years of experience as the dozens of voluntary letters from other satisfied amateurs and commercial operators, radio clubs, schools and universities will attest and which we receive daily. Let us back up this last statement by sending you the names and addresses of amateurs throughout the U. S. and Canada whose hook-up was designed by us. We have no catalogue to sell, we send you free our bulletin covering 22 up to date subjects at your request. On the other hand should you wish to improve your range or get better selectivity we will tell you how. These BLUEPRINTS are on sale by every first class dealer in the larger cities, are 21 x 28 and the dealers swear by them as they know they *are the goods.* A prominent New York radio engineer (not connected with our firm) recently said upon a close study of these prints, that they would go further toward simplifying radio than any one factor brought out in the last five years. If your dealer hasn't our BLUEPRINTS or bulletin, get in touch with us at once. All letters answered date of receipt.

EXPERIMENTERS INFORMATION SERVICE
Kenilworth Building, 45 Pinehurst Avenue, NEW YORK CITY



Price per cell $0.40
Add PP on ½ lb. per cell.

"CHI-RAD" APPARATUS

New Storage "B" Battery

At last a real Storage "B" Battery for your radio set. Can be used on receiving apparatus as source of plate voltage on both Detector and Amplifier tubes. Ideal as plate potential on small Radio Telephone or C.W. Transmitters. When discharged do not have to be discarded as with ordinary "B" Batteries but can be recharged again and again exactly like your "A" Battery.

SPECIFICATIONS

Cut one-half natural size.

Voltage per cell, 2 volts.

Pasted plates, ready formed for use. This means long life, battery ready for use upon the first charge given.

High ampere hour capacity—will operate one detector tube over 1000 hours with one charge. Shipped dry with simple directions for preparing the electrolyte.

NOTE:—A 22-volt battery of these cells costs but $4.00!

"GIVE US YOUR BUSINESS—
WE'LL GIVE YOU SERVICE YOU WILL LIKE"

DEALERS

Write for discounts and territory on this new item—the demand will be heavy Chicago Amateurs:—Come and inspect this battery and our general stock of Radio Apparatus—largest in the Middle West.

CHICAGO RADIO APPARATUS CO., Inc.
(SECOND FLOOR)
508 So. Dearborn St. CHICAGO, ILL.

STORAGE BATTERIES

Designed Especially For

WIRELESS

KICO "B" batteries give years of service. Are not harmed from short-circuiting, overcharging or standing idle. One charge lasts from three to six months while in the detector plate circuit. Can be recharged from your A.C. line in one hour. Money refunded if unsatisfied after ninety day trial. Prices as follows.

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Another suggestion I would make to every dealer in radio supplies: "Train your clerks in salesmanship and courtesy." The last is just as important as the first.

We all remember the boom times following the war, when anything could be sold. The demand was more than the supply. It seems to me, as an outsider, that much the same conditions apply in the radio game.

How many of us have gone into a radio store, been waited on by a clerk who always seems anxious to get rid of us, or a half baked youth, puffed up with the importance of his knowledge or job? This has happened to me time and time again.

Looking at it as an outsider and prospective buyer, it seems to me that the man who looks ahead, builds for the future and also considers the present, will gain a body of satisfied customers who will rely on his store and his judgment and he will become a leader in the retail end of the radio industry. It has happened in other lines of merchandise. Such men exist and some day I'll run across one and believe me I'll stick.

HUGH C. LLOYD.

The Hulbert Transrectiformer

(*Continued from page 706*)

tential direct current alone might be made the subject matter of a length article. Smoke precipitation, X-ray work, and many fields within the electrical and chemical industry will welcome a means of obtaining the much needed high tension direct current in a substantial device, which they need not fear will break down.

How I Received the American Amateur Stations in England

(*Continued from page 700*)

actual reception of the signals from America consisted of five valves (4 H.F. the 5th rectifying).

So loud were the signals on the morning of Sunday, December 11 (it was upon this occasion that messages were copied for two hours, the only breaks being caused by jamming) that four valves would easily have been sufficient for the reception of the signals and probably three valves would have given readable signals for a portion of that time. It was impossible, however,, to attempt this, as much of the message would have been lost during the necessary alteration to connections. Using the set (five valves) with the same strength of signals as experienced upon this occasion, an indoor aerial would have been quite sufficient for easy reception, and if a further series of tests be arranged at a future date the attempt will be made upon an indoor aerial.

On the following morning, Monday, two other stations were copied, but owing to fierce jamming it was necessary to close down. This occurred practically every morning. The success of the tests was, therefore, greatly marred by the repeated and terrible jamming of commercial stations, two of them, the Air Ministry and the Admiralty, being less than two miles distant and of fairly high power. These and other stations interfered almost continuously every session, and, although signals were heard practically every evening, most probably of American origin, it was impossible to copy them owing to the jamming.

In connection with these tests I wish to place on record my sincere thanks to my friends, Mr. E. McT. Reece and Mr. R. G. J. Brown, for their untiring enthu-

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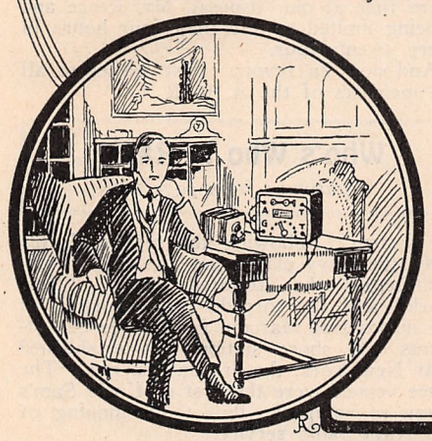

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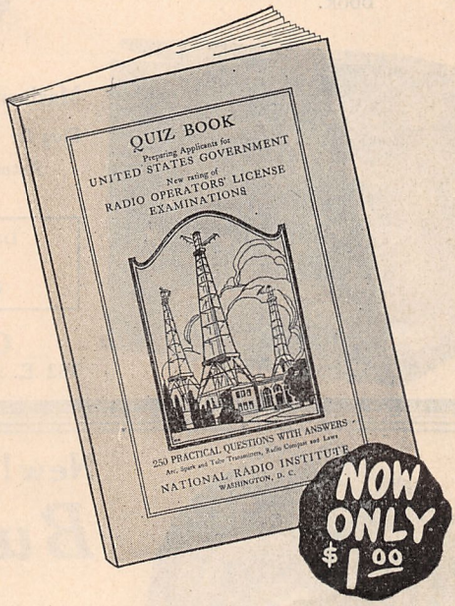

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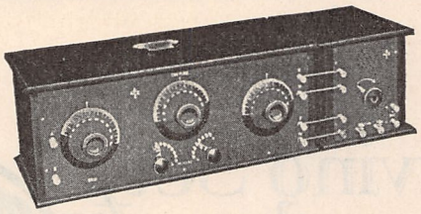
ACE  ACE

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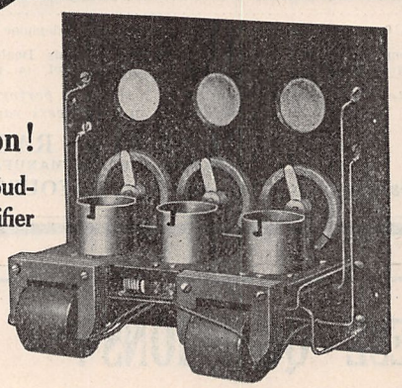

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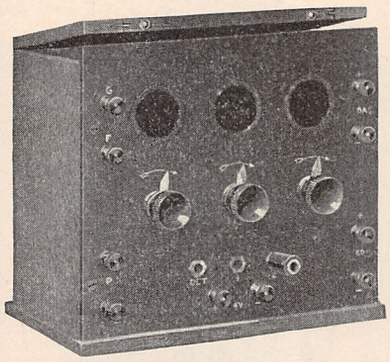

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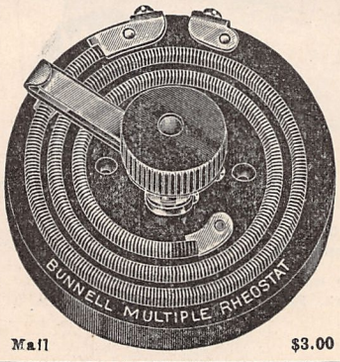

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siasm throughout. Without them it would have been impossible to have made the attempt at such short notice. Mr. Reece and I were always on watch together into the early hours of the morning. Mr. Brown assisted me greatly in the design and manufacture of the apparatus. We were all engaged in our separate occupations during the daytime, and every moment of our spare time was devoted to the manufacture and testing of the gear. Had there only been a little more spare time so that the gear could have been tried out on actual signals some time prior to the commencement of the tests, it would have been found that commercial stations came in on harmonics so badly, and due allowance could have been made for the employment of rejecting circuits. However, a great amount of experience has been gained in the last few weeks and great things are hoped for the next tests.

With the only exceptions of the valves, telephones and accumulator batteries, all the apparatus was of my own manufacture.

It has been a most enjoyable time, the only bugbear being the small amount of spare time at our disposal, Mr. Reece and I being limited to less than four hours in every twenty-four.

And now au revoir. Best wishes to all the members of the A. R. R. L.

Who's Who in Radio

(*Continued from page 717*)

the system. Following the report of this body, the Navy placed the battleship "Massachusetts," the armored cruiser "New York," and the torpedo boat "Porter" at the disposal of Marconi for further experiments. A shore station was established near New York, the first in America. The three vessels were the first of Uncle Sam's Navy so equipped; thus the beginning of the Navy radio service.

The growth and development has been remarkable. No part of the Atlantic or Pacific Ocean is too far away to be out of reach of a radiogram from an American Naval shore station. In fact during the World War, it was possible for Washington to keep in constant communication with its forces abroad through radio from the powerful New Brunswick station, equipped with the new Alexanderson high frequency alternator. America's terms for armistice were sent to General Pershing through this station.

Radiophone Broadcasting of Weather and Market Reports

(*Continued from page 717*)

wireless service maintained by the United States Post Office Department. In addition to the eight radio stations already in operation, newly-designated information-distributing points will be located in Texas, Georgia, California, Illinois, Montana, and one station in the New England States. A survey is now in progress to determine the exact locations of these radio telephony stations. The eight distributing points, originally established in connection with the transportation of mail by airplane, are located at Washington, District of Columbia; Cincinnati, Ohio; Omaha and North Platte, Nebraska; Rock Springs, Wyoming; Elko and Reno, Nevada. These radio stations will continue in operation, substituting radio telephone for radio telegraph outfits. If Congress accedes to the request of the United States Post Office Department in designating a "Bureau of Communication," appropriating $500,000 for its establishment and maintenance, the dissemination of information will not be confined to weather

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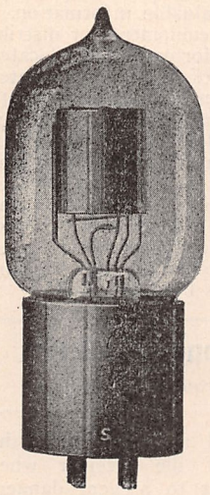

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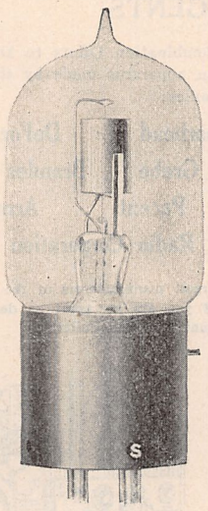

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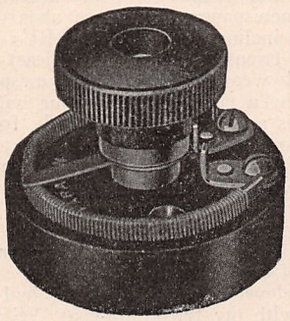

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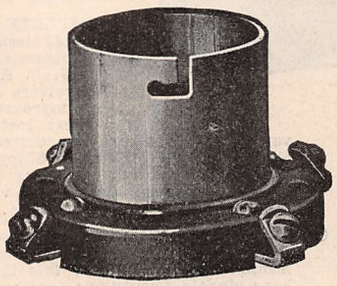

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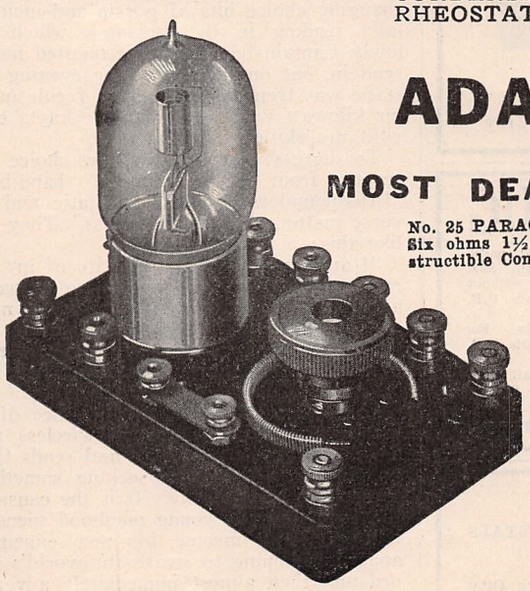

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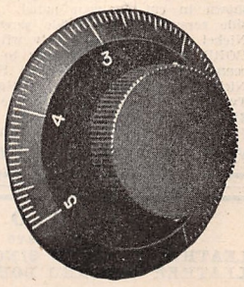

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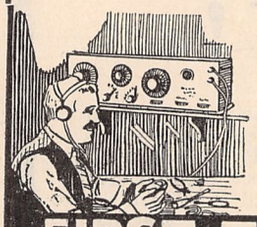

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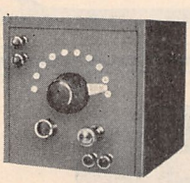

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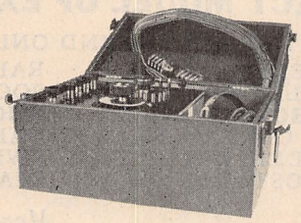

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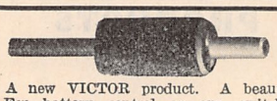
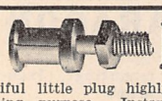

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The Radiophone at 2 B A K

(*Continued from page 705*)

this case being used to short-circuit the secondary circuit of the receiver when transmitting, in order to prevent dangerous oscillations being set up in this circuit.

It was at first found very difficult to make this set oscillate below 260 meters, but the set is to be remodeled so as to operate on amateur wave-lengths.

Mr. Sparks at Sea

(*Continued from page 718*)

me and have lunch immediately afterwards. Golf on deck at three, perhaps a little Tennis and Bowling and Billiards in the evening, followed by a light lunch of Almonds, Soup, Fish, Fowl, Beef, Salad, Olives and Celery, Pie, Cake, Ice Cream, Coffee and Liquors. At ten I will get a time tick and dictate some press from the stock of newspapers I brought aboard. If I feel so inclined I will get QRUs from fifteen or twenty ships and broadcast some news and weather from my newspapers followed by a conversational hour with all my friends and will then be ready for assistance to bed."

In all fairness I must state I never saw a more willing retinue, my slightest wish was their most imperative command. Need I narrate the happy days between New York and my first port? I believe one incident will suffice.

Up to eleven thousand miles I had been in touch with my friend John at WSE, exchanging choice bits of gossip and incidentally sending in the messages which the lowly Captain had humbly requested me to send in, but on this particular evening the static was tremendous and my feeble quarter kilowatt would not span the knots even with my skilled handling.

To digress a moment, a few choice excerpts from my operators' hand-book "Brasspounders' Guide," on static and diverse matters will not be amiss. They run like this:

"I am sure the large majority of my enraptured readers have a shouting acquaintance with our friend static, although modesty forbids revealing what is shouted. For the fortunate few who have never listened to this balm, a few vivid descriptions will be given.

"Static is the concentrated essence of all that gives otherwise normal wireless men a wild look about the eyes and sends them up and down the decks seeking something to chop with a fire axe. It is the cause of the flower of our young manhood spending half of Pop's income for new expensive apparatus hoping to smash the world's record and then almost immediately advertising it for exchange, so if the prospective

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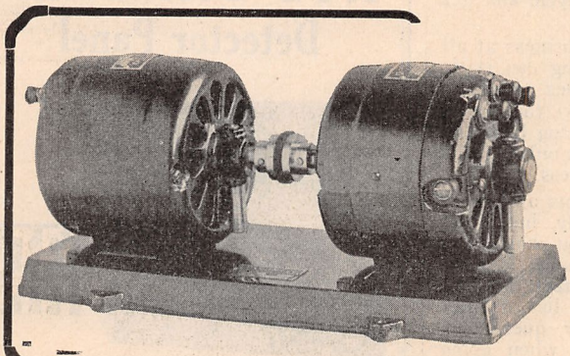

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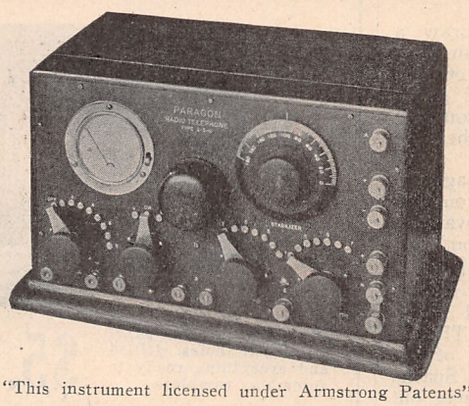

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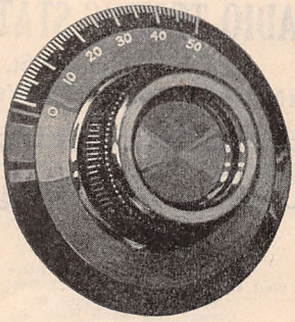

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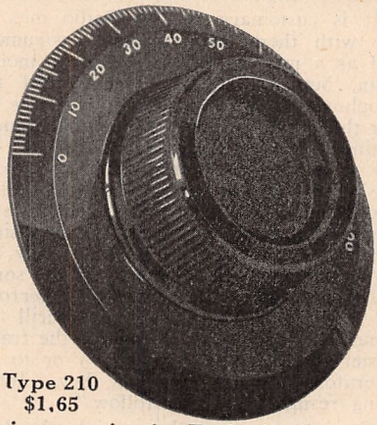

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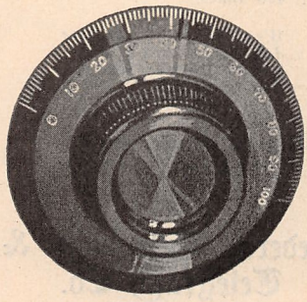

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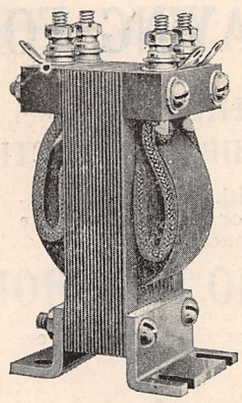

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young radio enthusiast sees an Ad running something like this, 'For exchange, Complete Modern Radio Outfit for one Soap Bubble Blowing Outfit, Address Distracted, c/o Padded Cell,' let him beware for 'tis better to buy a motorcycle and get dead all over."

To the rushing newspaper business at all docks immediately before sailing can static be traced directly, so if one sees an otherwise breezy individual drag Mike the Newsboy behind a crate and do rushing business, he may not be alarmed for it is only Sparks getting his first two weeks' press.

I am sure other literary gems also mention static more or less briefly, but if an extensive treatise is desired you should buy my book, without which no home is complete. It contains sign language for operators speechless with rage, a list of stock press items which are never questioned, twelve pages on how to act when going aboard a ship for the first time, and so on. A few gems follow:

"When meal time approaches, draw a chalk line outside the wireless room door and with spiked shoes tightly laced, get set. When the mess boy rings the bell get a good start and if you don't slip you will get a fairly good meal, but remember the competition is very keen."

"When the Captain files a message insist that the anchor be dropped so you may get a good ground. He may not want to do this, but do not let him fool you."

"When a goodly accumulation of laundry is at hand to be washed and ironed, approach the Chief Engineer and diplomatically suggest that he do it. This is the usual and time honored custom of the Chief showing his appreciation for Sparks blowing his fuses and perhaps burning out his generators in his private research work, for the advancement of science. If the Chief is ill or indisposed the Chief Steward is always willing to oblige and show his appreciaton of Sparks eatng all of the food in the icebox, a place where all good operators of normal health love to roam."

"It is customary for all Radio men to take with them some musical instrument such as a pair of dice, a banjo or mouth organ, but we specially recommend the saxophone, because the Captains love to hear the heavenly charm of this instrument continually playing the scale. In fact, he gets so that he is going along about one note ahead of the earnest Sparks. The saxophone can be heard all over the ship and tends to popularity, so is to be desired as funds are often thus raised to buy accordions, parrots or something of the sort."

"An interesting experiment to perform and which never fails to give a thrill and valuable experience is to connect the transformer terminals to the primary or to the generator line and press the key. Interesting results invariably follow."

"To put some spicy humor into the daily press, some witty remarks such as 'The editorial staff notices that the Captain has not shaved for four days now, we come to the conclusion that he is saving up for a hair cut all over,' are recommended. This always brings the attention of the busy Captain to the Wireless Department, especially on passenger ships."

Returning to my narrative, I sent my cabin boy to the Captain informing him that it was impossible to get the message off and what was he going to do about it. Almost immediately he bustled in, the personification of sympathy, assuring me that the message was of secondary importance and asked me if I wouldn't be helped to bed after my strenuous efforts? The look in his honest blue eye was touching to the most hardened hearts, so I consented.

The close of my narrative is the moral

ALWAYS BELIEVE WHAT YOU READ

because no breathless goggle-eyed tale is complete without a moral.

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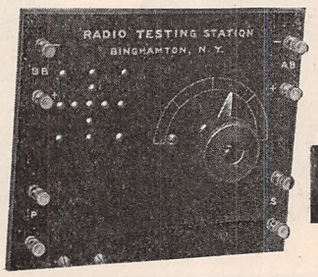

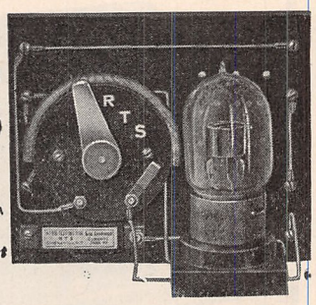

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Amateurs Span the Atlantic

(*Continued from page 699*)

counterpoise through the said variable set at 43 degrees, the radiation is four and two-tenths amperes."

The University of Vermont Radio Association shows us the circuit with which they crossed the Atlantic with special emphasis on their aerial and ground system.

"The aerial and ground system which we consider one of the main features of the station is as follows: The aerial is composed of a 4-wire T, 85′ long, and 55′ high, with wires spaced 3′ 3″ apart. We use a ground for the spark set, composed of buried wire and other metals. For C.W. we use a counterpoise which is exactly under the aerial. It is about 3′ from the ground (under the building), and has 4 wires about 90′ long spaced 8′ apart. The lead-in from each wire is the same length, and as the station is on the ground floor, the lead-in is not very long."

On the other hand we have the story of the Worcester Polytechnic Institute which happily enough "crossed" the "pond" without even attempting it. Incidently, the Institute has been kind enough to present to other amateurs a very concise and explanatory circuit diagram reproduced herewith. Part of their story follows:

"In answer to your questions, I do not know the exact date of the fortunate transmission. We were making no attempt to reach England at the time we were reported, but were simply trying to get into communication with some one of the amateurs nearby. It was on the evening of either December 9 or 10, 1921.

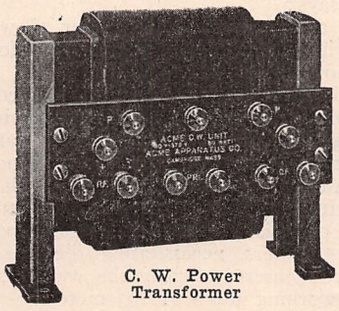
"Most of the rest of the information that you want is contained on the diagram of connections that I am enclosing. We used one Radiotron U.V.-203 with 600 volts on the plate, both straight and interrupted C.W. We were radiating about 1.2 ampere into each end of the multiple tuned antenna at about 235 meters."

And now we have a few remarks from the time-honored "stone crushing" sparks.

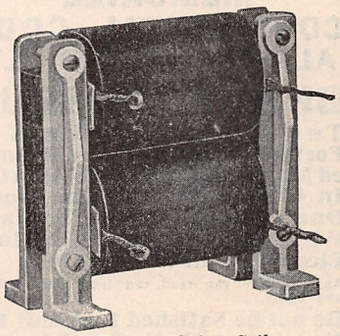
3FB at Atlantic City tells us that he was using a 1-K.W. spark set located in the basement and operated by relay from the third floor of his home. We quote from his letter: "This set consists of a 25,000 volt transformer, home made ¼" plate glass in oil, capacity .012 mfd.; a four-stud, 8" disc recolving at 2500 r.p.m.; an O.T. 18" in diameter of 2" copper ribbon, hinged pancake type; 1¼ turns are used in the primary, and 4½ in the secondary. All the parts are home-made except the transformer. The set is in a large packing box to eliminate the noise, and arranged so as to have very short leads. The total length of leads in the oscillating circuit is less than 10"; radiation, 4½ amperes on a hot-wire meter.

"The aerial is a seven-wire cage, 6′ in diameter at the high end and 4′ at the lower, with a 10" cage lead-in. It is supported by two wood masts; one on the ground 40′ high and the other on the house. total height 75′. All guy wires are cut up by insulators. The ground is of burned wires, driven pipes, and the water mains, all joints having been soldered together."

2BK, who makes enough noise evenings to be able to carry on to Mars as well as to Scotland, does not burden us with a lengthy report of the "how and why" his spark crossed. His timely remarks, however, may interest other spark users who are looking for enough report cards to



C. W. Power Transformer



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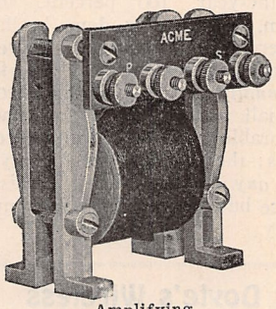

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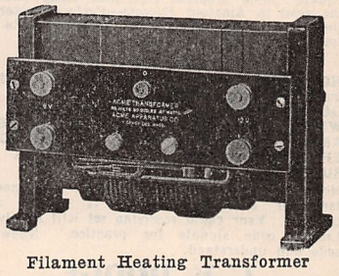

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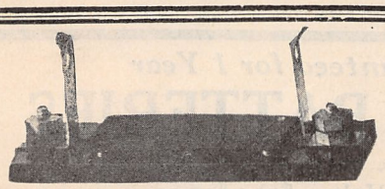

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papers the walls of their shacks. Mr. Trube says:

"The antenna consisted of four 1" wide brass ribbons each 40' long, in the form of a horizontal fan, 25' to 45' wide, 75' from the ground. The lead-in was composed of four No. 14 enameled copper wires, 65' long. A counterpoise and 'tuned' water-pipe ground was used. The counterpoise was made up of five brass ribbons, each 70' long with a 72' jumper across; the natural period of this antenna and counterpoise was 215 meters, necessitating the use of series condensers to bring the wave down to the working wave of 203 meters.

"The transmitting apparatus consisted of a 1-K.W. Marconi open-core transformer, 50,0000 volt, .015 mfd. power condenser, 8-stud 'synchronous' gap (14" disc going at 1800 R.P.M.), and heavy oscillation transformer (primary ribbon 12" wide).

"This appartus put 5.8 thermo-amperes into the above antenna at 203 meters, with a power input of about 800 watts. Signals from this station were reported in Androssan, Scotland, for the first time during the early evening of December 10, 1921.

"Signals from this same apparatus have been reported from Colon, Panama; Los Angeles, San Francisco, Pasadena, and Pomona, California; Billings, Montana, and in a total of 40 states."

And so we could go on describing the sets of the various winners if we had space. The ones mentioned here, however, will serve to give the reader a close-up of the average station having successfully competed in the trans-Atlantic tests.

With all due fairness to the triumph of amateur radio in thus conclusively proving that vacuum tube transmission has come to stay, the casual reader must remember that short-wave trans-Atlantic amateur communication on outputs less than 1-K.W. is one thing when accomplished during one of the most favorable seasons of the year under somewhat special conditions, and that at the present stage of the game it is quite another matter to make this sort of international communication a reliable, every-day-of-the-year, 100 percent, foolproof medium, as is being done by high power commercial radio. Indeed, there is a vast difference between the two. The first does it *occasionally*, while employing a comparatively small amount of power under the most favorable transmitting and receiving conditions; the second does it all year round under *any* conditions and furnishes reliable service but requires relatively much greater energy.

Larry Doyle's Wireless

(*Continued from page 719*)

ful signs of being thrown off his guard, after a bit turned towards Mulligan and with a knowing grin piped, "Mulligan, you are as musical as a colleen with a ukelele, but if there's anything particular you want to know there's a good many ways you can't find out."

"Well, Larry, 'tis curious I am to know where did you get the crocks."

"That's all, is it? Well, if I mind where they came from I think I beat a Swede staying awake for them."

After several other unsuccessful attempts to get a line on Larry's plans, Mulligan gave up in despair and stoking his pipe returned to the bunkhouse.

The following evening, after the men had had supper and were filling their pipes, Mulligan, who was standing near the window gazing trackward, cried out: "Look, Quinn, Grogan, look! here comes one bearing gifts."

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.002 Mf. Phone Condensers	.25
Variable Grid Leak, ½ to 3 Megohms	.28
Electrose Ball Insulators, each, per dozen	3.00

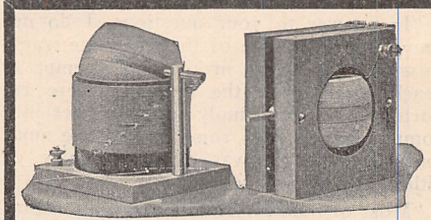
MARKO STORAGE BATTERIES

4 Volt 40 Amp.	7.50
4 Volt 60 Amp.	10.50
6 Volt 40 Amp.	10.50
6 Volt 60 Amp.	14.00
6 Volt 80 Amp.	18.00

We do not charge for crating. *The above Prices are F.O.B. New York. Above Batteries are fully charged when shipped.*

Hygrade Electrical Novelty Co.

41 West 125th Street New York



Variometers Couplers **$3.75 each**

Wound but Unassembled **$3.00 each**

These instruments embody best workmanship and materials, all wooden parts genuine mahogany, coupler primary wound on Formica tubing. Wound to assure maximum results for short wave work. Shafts 3/16 inch. With Chelsea Dial and Knob, $1 extra. Send for bulletn describing panels, parts and other apparatus.

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Radio 9XAB

We are the authorized jobbers in the following States, (Missouri, Kansas, Nebraska, Oklahoma, Texas, Arkansas, Louisiana, Iowa, Arizona) for Radio Corporation products. Largest stock west of Chicago. Always fresh. We also carry all standard makes of apparatus. Listen for our 250 watt phone set, 11:30 A.M., 2:00 P.M., U. S. Government Markets and Weather sent out on above schedule. Concerts at 7:30 and 8:30 P.M. Dealers write us.

WESTERN RADIO CO.

6 WEST 14th ST.

KANSAS CITY, MO.

A hundred yards down the trail, Larry was trudging along headed for the bunkhouse. It was a hot night and although Larry had on no more clothes than would decently pad a crutch, he was puffing along under the weight of one of the mysterious water coolers carried on a shoulder. In one hand he carried a broom handle and a common red globe railway lantern.

Arriving at the shack, Larry, maintaining an air of academic reserve proceeded to set the cooler on a stool near the window from which the depot, a mile away, was visible. On the floor, and beneath the spigot he placed an empty bucket, and then proceeded leisurely to fill the cooler with water.

Mulligan, Quinn and the rest of the gang, during these operations, hovered near in various attitudes of ease, each contentedly pulling upon a well-seasoned dudeen. Several times Mulligan cleared his throat with the evident intention of soliciting data, but in each instance Larry produced a silent, though effective, deprecation which postponed until he was ready any explanation of the great invention.

Finally, Larry lighted the red lantern, and taking up the broom handle which was weighted at its lower extremity and had a series of notches cut along its length at intervals of an inch or so, inserted the stick, weight down, into the water cooler.

"Now, come here, you, Mulligan, an' if you have an atom of intelligence let me describe to you how the wireless works. You see this stick: it has ten rows of small marks on it, numbered one, two, three, four, an' so on down to ten, startin' from the top of the stick. As the stick stands upright in the water jar mark number one is seen an inch below the surface of the water; mark number two, two inches below the surface, an' so on down 'till number ten is reached, an inch from the bottom. Now, are you follerin' me or am I alone?"

"Go on, Larry, go on; 'tis as plain to me as the nose on your face."

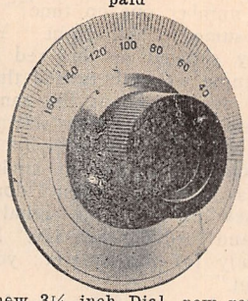
"Mulligan, if it weren't for the demands of service I'd push you into the canyon. Now listen to me here: on this card there is a schedule of signals Casey at the depot has a card the same:

1. Come to the depot with three men.
2. Come to the depot with whole gang.
3. Bring lunch pails.
4. Roadmaster wants to speak to you by wire.
5. Wreck. Bring all men and tools.
6. Yes.
7. No.
8. Is number one on time?
9. Is number two on time?
10. Open envelope and read message.

"Casey is at the depot and I will proceed to demonstrate to the whole winkin' and grinnin' outfit of you how to communicate with him."

Larry placed the red light in the window, and in a few seconds the watchers saw a red light shine forth where Casey's shack was situated. Immediately Larry turned on the spigot and the water began rapidly to pour out of the cooler into the bucket beneath. Within a minute or so the water in the cooler had fallen to a level corresponding with the mark "8" on the immersed stick. Larry quickly removed the lantern so that it could not be seen from the distant station. In the distance, Casey's red light disappeared a moment later. Like a man of mystery Larry leisurely proceeded to pour the water back into the cooler; observing to Mulligan: "You seen that the water stopped leakin' when I turned the spigot handle, and the message sent was

The 4 inch Dial Now $1.75 Postpaid



A new 3¼ inch Dial, now ready, $1.60 Postpaid

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The real Bakelite Knoa Isan example of master moulding and fits the hand and lacquered and furnishes a pleasing contrast to the black panel.

The Dial is now made with enlarged center hoe, so that no contact is made to instrument shaft, thus—the Dial may be made to serve as a shield to body capacity effects. An exclusive feature.

Order from us with the rest of your requirements—or from your local dealer.

SPECIAL—We will attach our Dials to Amrad, Remler and Chirad Variometers and Chelsea Condensers without charge.

Deduct price of regular dial—add $1.75.

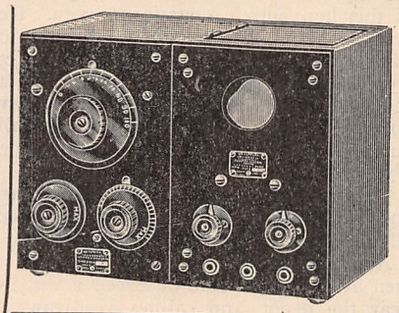
WHILE we cannot list even a portion of our varied stock, we call to your attention a few specials which find ready favor with our local clients.

YOUR SMALLEST ORDER SENT PROMPTLY AND POSTPAID

$1.65 DeForest Filament Rheostat	$1.10
$1.25 DeForest Moulded V.T. Socket	1.00
10% Discount on DeForest DL Coils,	10%
.001 Mfd DeForest Variable Vernier, Condenser, dissembled	4.75
G.R. 231A Amplifying Transformer	5.00
Amrad Shielded Ampliformer	6.00
75 Watt Acme Filament Transformer	$12.00
Type JX 0-15 Voltmeter, Flush	8.00
Bunnell Line Rheostat, 28 Ohms	3.00
Somerville Mica Condensers, 1000 V, .00025 and .0005 Mfd $1; .001 and .002 Mfd	1.25
Federal 800 HY. Filter Coil	7.50
Wimco C.W. Inductance, Dissembles	8.50

With every pair of No. 56 Murdock 3000 Ohm Phones at $6, we furnish a Federal Universal Plug for $1.00 extra.

With every JK Hand Microphone with cord at $6, we furnish a Federal Universal Plug for $1.00 extra.



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Complete Antenna and Ground Outfit	$ 7.00
Westinghouse Receiver Cabinet	130.00
1 UV 220 Radiotron Detector Tube	5.00
2 AP Amplifying Tubes @ $6.50	13.00
2 No. 766 Eveready "B" Batteries @ $3	6.00
1 Forsine 6 V. 60 Amp. Storage Battery	15.00
1 Brown Type A Adjustable Headset	18.00
1 Round Firco Cord Plug for above	2.50
	$196.50

WESTINGHOUSE RECEIVER $130.00

This is the improved model, completely shielded, with smooth running Rheostats and provisions for using "soft" detector tube. (Sent express prepaid).

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SEND US YOUR ORDER TODAY! OUR "OK" MEANS YOUR SATISFACTION

—REMEMBERING—
Our Catalog—25c

SPECIAL!—THE NEW AMRAD "S" TUBE NOW READY

The tube without a filament, which will revolutionize amateur CW.

$7.50 EACH *(two needed—instructions and hook-up included.) We will be the first distributor to have a stock! ORDER NOW!*

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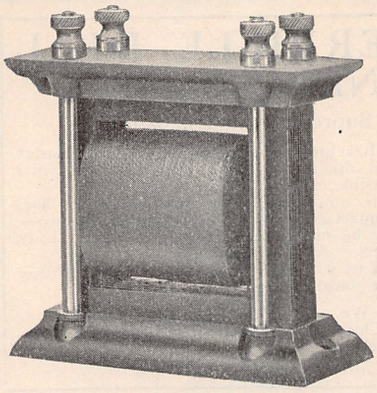

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Impedance Values at 1,000 Cycles
Primary with Secondary Open
36,175 ohms
Primary with Secondary Shorted
1,875 ohms
Secondary with Primary Open
1,875,000 ohms
Secondary with Primary Shorted
55,000 ohms
An instrument that will make you proud of your Radio Station

Price as shown, $4.50
Unmounted $3.75

Purchase from your dealer
Bulletins sent upon request

CHELSEA RADIO CO.
150 Fifth St., Chelsea, Mass.

THE "QSA" LINE OF RADIO EQUIPMENT

SERVICE?—Pshaw!

We could fill a page talking about it We have, of course, the utmost confidence in our ability to live up to any promises we might make. But, since you are the judge, all we ask is an opportunity to demonstrate our ability to give you the kind of service you want. We list below, for your convenience, a representative group of radio supplies. Most of the items are just what you need to put your set in shape for real DX work. Well then, send your order in at once and give us the chance to prove ourselves. We will appreciate it.

Radiotron U.V.200 detector	$5.00
Radiotron U.V.201 Amplifier	6.50
Radiotron U.V.202 5 watt transmitter	8.00
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Acme 1K.W. Spark Transformer	28.00
Acme Amplifying Transformer	5.00
Brandes Navy Type Phones	14.00
*FADA Panel Mounting Rheostat	1.00
PR-536 "A" Battery, Potentiometer	2.00
45V. B. Battery special at	1.85

*These are listed at the new reduced price. Of course we handle many more items than listed here, but that is why we have a

CATALOG

Sent for 10 cents which amount will be refunded on initial purchase amounting to $1.00. Send for it TODAY.

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"BETTER RESULTS WITH LESS EFFORT"

THE AMATEUR RADIO CENTRAL
IN LONG ISLAND
OPENS FEBRUARY 1st
Test our service and prices.
Specials every month.
RIDGEWOOD RADIO SHOP
1603 Myrtle Ave. Ridgewood, L. I.
ALL cars to Wyckoff Ave. reach our door.
Mail orders given immediate attention.

number 8. Now look at the schedule and see what it says."

Referring to the card, Mulligan read aloud: "Is number one on time?"

Larry resumed: "All right. You see when Casey showed me his red light in answer to mine we both turned the spigot handles of our crocks at the same time, and as they are both the same size and both outlets the same, the water in his jar had fallen to number "8" on his stick at the same time as mine, and when I doused my glim he knew that was the signal to stop the water and read the message. Now we are all ready for the answer: yonder is his red light."

So saying, Larry again exposed his red light in the window and turned on the water. Within a minute Casey's light disappeared, and Larry, in turn stopped the flow of water from the cooler. The level of the water was at number "6" on the stick.

"Now you blatherin' skeptic, what is the answer?"

Scanning the card, Mulligan put the stump of a finger on number "6" and read: "Yes."

"Of course, he says yes; and it means number one is on time: that's what we axed him. Now, Mulligan, I am going to the depot, and I transfer the responsibility of this here wireless station to you. Keep your red lamp handy and every once in a while take a peep over the prairie in case there's a message coming. I leave you the schedule, also a sealed envelop which must not be opened unless you are signalled number "10." It contains secret orders, d'ye mind."

"'Tis a great invention you have, Larry, and I'll do my best to transmit and record all necessary communications."

About an hour after Larry departed, the men at the bunkhouse observed a red light near the depot, and calling Mulligan, that worthy placed his red lamp in view and turned on the water.

As the level of the water fell rapidly, passing number after number, without the distant lamp ceasing to show, Mulligan becoming nervous, remarked to the men that he thought something had gone wrong with the valves or the mainspring. Presently, however, Casey's lamp disappeared and, turning off the spigot, Mulligan read off number "10." Turning to the men, he said: "Here, Quinn, the card says number ten means 'open the envelop and read the message.' Your eyes are better nor mine: open the envelop and see what is wanted."

Quinn, rising to the occasion, opened the envelope, unfolded the enclosed paper and read as follows:

To Mulligan:

It is many a day since you bought anything for anybody except yourself. You are hereby ordered tomorrow to buy Mister Doyle a pound of R.R. Plug Cut, in view of your various sarcastic references forninst the wireless.

Casey.

Airplane Phone and Spark Sets

(*Continued from page 720*)

mounted in the fuselage. This instrument brings the open oscillating circuit into resonance or agreement with the closed circuit, a condition revealed by the maximum current reading on a hot wire ammeter in the variometer box. The absence of a battery to exhaust its energy or other auxiliary unit to refuse to function are negative fac-

(*Continued on page 777*)

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Operation to the Last Volt!
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Burgess "B" Batteries Do It.

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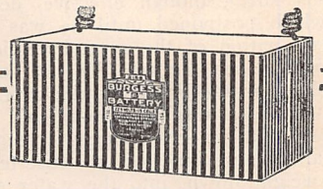

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WE ARE DISTRIBUTORS OF HIGH GRADE RADIO APPARATUS WITH THE BEST OF PRICES AND SERVICE

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6 x 9 x 3/16	$1.00
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Baldwin Type C Phones	13.75
Baldwin Type E Phones	15.00
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The Vacuum Aerial Protector for Wireless Receiving Stations

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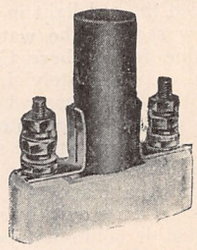

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$2.00

From your dealer or sent direct

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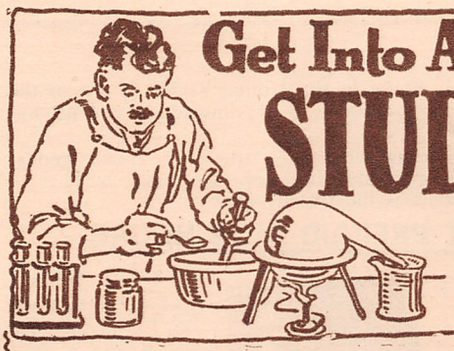

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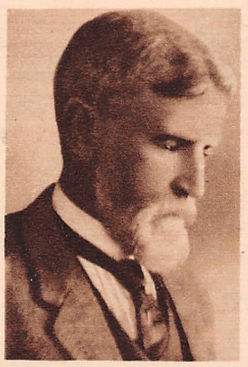

DR. T. O'CONOR SLOANE, A.B., A.M., LL.D., Ph.D.
Noted Instructor, Lecturer and Author. Formerly Treasurer American Chemical Society and a practical chemist with many well known achievements to his credit. Not only has Dr. Sloane taught chemistry for years but he was for many years engaged in commercial chemistry work.

Never before has the world seen such wonderful opportunities for chemists as exist today. The war has awakened the United States to the need of trained chemists and chemical engineers. Everywhere the demand has sprung up. In factories, mills, laboratories, electrical shops, industrial plants of all kinds, the lack of trained chemists is acutely felt. In every branch of human endeavor the need for chemists has arisen. No profession offers such alluring opportunities—and the next ten years are going to show the greatest development in this science that this country has ever seen. You be one of the fortunate to get in now.

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I have also some more news for you. **I have been made Assistant Chemist for the concern I am working for** so you see I am making some progress. I hope also that you will like that bit of news.

Hoping to hear from you very soon, I am, your student

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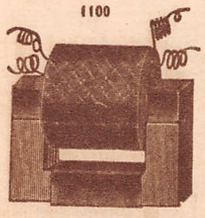
Be sure to get our great catalogue, containing several hundred different parts, which is illustrated below.

ORDER DIRECT FROM THIS PAGE. ALL GOODS SENT PREPAID IN 24 HOURS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"RASCO" AUDIO FREQUENCY TRANSFORMER

We have compared many of the present transformers on the market but have finally decided upon a type that is the most efficient one we have seen so far. The best amplifying transformer is that in which the impedance of its primary is equal to or exceeds the impedance of the plate-to-filament circuit of the tube in which it is connected.

We guarantee this transformer to equal any one on the market.

No. 1100 "Rasco" Audio Frequency Transformer **(not assembled) each prepaid**.....$2.65

ANTENNA CONNECTOR

This antenna connector is made entirely of aluminum, is light and will not rust. The only connector of its kind. The 4 antenna wires go to the upper holes; the lower hole takes the lead-in. Don't solder your aerial, don't have loose connections. Dimensions 2" high, 1¾" wide, ⅝" thick.

999

No. 999, Connector, each..$0.35

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6241

838

No. 6241 is well made and has a good corrugation. Its dia. is 1", height is ½", hole 5/32". The shank is ¼" high.

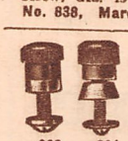
No. 6241, Knob, each.....$0.08

MARCONI KNOB

Has a central hole of 5/32" and seat to hold the screw, dia. is 1¼", height ¾".

No. 838, Marconi Knob, each.....$0.15

RASCO POSTS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030 029

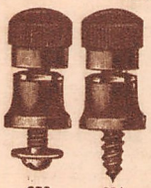
These are our very own patterns, from our own designs and look mighty handsome on any instrument. The top knobs are of composition, the bottom parts brass nickel plated polish.

No. 202 is nickel plated at bottom part.

"Rasco" Binding Post, 8/32 thread, each, $0.10; doz., $1.00.

No. 202, Post, each, ...$0.08

Nos. 650 and 651 made entirely in composition with a hexagonal brass nut in center.


650 651

No. 650 has 8/32 machine screw.
No. 651 has bottom wood screw.
No. 650, Post, each.....$0.08
No. 651, Post, each.....$0.08
Dozen, each style.....$0.90

BRASS NICKEL POSTS

No. 029, Binding Post, each.....$0.05
No. 030, Binding Post, each.....$0.04

RASCO SWITCH POINTS

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Nickel plated and polished. The following have been found the most popular.

No. 1 ¼"x¼", 6/32 thread, ea., $0.03; doz., 35c
No. 2, 3/16" high, ¼" dia., 6/32 thread, ea., $0.03; doz., 35c.
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No. 6, 3/16" dia.; 3/16" thick; stem 4-36, ea., $0.03½; doz., 40c.
No. 7, 3/16" dia.; ⅛" thick; stem 4-36, ea., $0.03½; doz., 40c.
No. 75, Switch Stop, ⅞" long, 4-36 thread, complete with nut, ea., $0.05; doz., 50c.
No. 76, New style Switch Point, to be pressed into bakelite panels with forced fit. Wire is soldered to pin end. Head ¼"; dia., 1/16" thick, ea., $0.03½; doz., 40c.
No. 77, same as above, but head is ¼" dia. x 3/16" thick, ea., $0.03½, doz., 40c.

1898

THE RASCO BABY DETECTOR

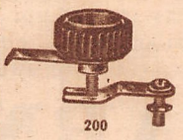
In presenting this little Detector, we feel sure that it fills a place never taken before by any small detector. It does a variety of things and does them all well and better than many $5.00 detectors. The base is solid, black composition. Mounted on same is a nickel holder and binding post which holds a flutted hard rubber knob with its sliding rod member.

The outstanding part of the Detector, is the patented nickel detector cup and binding post. The knurled cap unscrews and you place the Galena Crystal in the cup, then replace the knurled cap and the galena crystal is held secure. The circular hole in the cap exposes enough of the crystal for ordinary purposes.

No. 1898, Rasco Baby Galena Detector. Price, prepaid.....$0.50
No. 1899, Rasco Baby Detector with Galena and Radiocite Crystals. Price, prepaid.....$0.75

PANEL SWITCH LEVER

New style switch lever with lock fork. It is impossible for this lever not to make positive contact at all times. The blade radius is 1¼". Blade is nickel plated and polished. Fork is phosphor bronze. The lock fork holds the screw (in which it rotates), securely. A loose contact is impossible.


200

No. 200, Switch Lever, complete as illustrated..$0.30

LITZ WIRE

323

This wire is recognized as the only thing for winding coils for Radio instruments. Particularly recommended with our **No. 343** Variocoupler Rotor, for vario-couplers, banked windings, etc.

No. 323, Litz Wire, 20 No. 38 strands, enameled double silk wire, per foot, $0.02; per 100 feet, $1.15

No. 890, Litz Wire, 10 strands No. 38 wire, per foot, $0.01; per 100 feet, $0.75.

No. 891, Litz Wire, 16 cables of three strands No. 38 wire, per foot, $0.03; per 100 feet, $2.25.

NOTE: This page contains only a few of our 300 specialties.

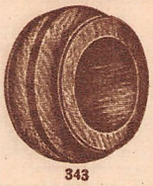
PANEL KNOB

This is a very distinctive knob and can be used on dials, panels, switches, condensers, etc. It is exceptional and well made. Dia. 1 1/16"; height 11/16"; comes with 8/32" bushing.

815

No. 815, Knob, each.....$0.18

VARIOCOUPLER ROTOR


343

This rotor is used by all up-to-date amateurs. Is accurately turned of hard wood and is used as a secondary coil. It takes any finish, either shellac or stain and can be drilled readily for any size hole. Large hole 2" dia. Width of spool is 2". Total dia. 3⅜".

No. 343 Variocoupler Rotor, each.....$0.75

827

"RASCO" NAME PLATES

839

Our name plates are of brass with a black background. Letters are polished nickel. Order by name and number.

	Each		Each
807 "Phones"	$0.05	810 "Ground	$0.05
809 "Aerial"	$0.05	812 "Primary"	$0.05
811 "Secondary"	$0.05	814 "Detector"	$0.05
813 "Audion"	$0.05	866 "On"	$0.05
865 "Off"	$0.05	840 "Increase Current" (Left)	$0.10
839 "Increase Current (Right)	$0.10	834 "Series"	$0.05
813 "Vacuum Tube"	$0.05	830 "Receive"	$0.05
831 "Transmit	$0.05	820 "2nd Step"	$0.05
821 "3rd Step"	$0.0	827 "Tickler"	$0.05
819 "1st Step"	$0.05	825 "Plate Variometer"	$0.05
826 "Grid Variometer"	0.05	835 "B Battery"	$0.05
823 "Secondary"	$0.05	817 "Output"	$0.05
836 "A Battery"	$0.05	824 "Primary Condenser"	$0.05
818 "Input"	$0.05	828 "Parallel"	$0.05
829 "Telephone"	$0.05	837 "+ —"	$0.05
833 "Detector Tube"	$0.05	841 "(Blank) "(takes pen or pencil writing)	$0.05
822 "Coupling"	$0.05		
808 "Load'g Coil	$0.05		

Price of all of our name plates in dozen lots, 50c, with the exception of the two "Increase Current"

350-55

BAKELITE PANELS

We list below six panels, the sizes of which have been selected after carefully checking up many dimensions of the most popular radio apparatus on the market.

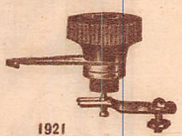
Note particularly that our prices are anywhere from 25 to 50% lower than those quoted by most other concerns. The reason is that we buy these panels in very large quantities, **and we do not cut sheets to order.** Remember always that when sheets are cut to order they cost you at least 50% more than our prices, because **you must pay for the cutting and the necessary waste.**

Note also that we ship these panels prepaid. This alone amounts to a considerable saving.

No. 350	6"	x 12"	x 3/16"	thick,	each	$1.90
No. 351	6"	x 18"	x 3/16"	"	"	2.85
No. 352	9"	x 12"	x 3/16"	"	"	3.00
No. 353	12"	x 18"	x 3/16"	"	"	5.65
No. 354	6½"	x 19½"	x 3/16"	"	"	3.50
No. 355	6"	x 7½"	x 3/16"	"	"	1.20

"RASCO" LUBRICATED PANEL SWITCH

A radio switch that has two nuts at the end is a monstrosity, for the reason that it will never stay put. Our patent spring fork holds the switch handle always under uniform tension, at the same time it insures the best contact possible. **New wiping contact**, which covers every point of the switch point. Another new improvement is the lock fork, which can assume three different positions to accommodate the switch to various thicknesses of panels.


1921

No. 1921 "Rasco" Switch, as illustrated, each $0.50.

KNOBS

199

4451

These knobs are favorites with all experimenters The size of both is: dia. 1½", height ⅝". No. 4451 comes with 8/32 and 10/32 bushing.

No. 4451, Knob, each..$0.06
No. 199 (screw length ⅝") Knob, each $0.10

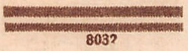
NAVY KEY KNOB

This navy key knob is now used on all standard wireless keys. It gives the right swinging motion and rests the fingers. It is a favorite with all advanced amateurs. Once used always used. The screw is 8/32 and will fit all keys.

748

No. 748, Key Knob, each.....$0.28

THREADED BRASS ROD


8032

We carry two styles, 6/32 and 8/32 thread. **Only 6" lengths sold. No others.**

No. 8032, Threaded Brass Rod 8/32 thread, per 6" length $0.08
No. 6032, Threaded Brass Rod, 6/32 thread, per 6" length $0.06

THE "RASCO" CATALOG

CONTAINS 50 VACUUM TUBE HOOK-UPS

Complete hook-ups of all important vacuum tube circuits are given in clear diagrams with complete explanation. Just to name a few.—The V.T. as a detector and one-step amplifier; regenerative circuit; De Forest ultraudion; V.T. to receive undamped and spark signals; Armstrong circuits; one step radio frequency amplifier and detector; three stage audio-frequency amplifier; short wave regenerative circuits; V.T. radio telephone; 4-stage radio frequency amplifiers; radio and audio frequency amplifier, inductively coupled amplifier; Armstrong superautodyne; radio frequency amplifier and crystal detector; etc., etc. The catalog contains 200 illustrations. On account of its great cost, it cannot be distributed free of charge. Mailed only upon receipt of

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15c in stamps or coin.

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This business was originated with the sole purpose to cater to the amateur who has small orders. ALL OF OUR ORDERS ARE SMALL and that is why your small order will never be sidetracked by us. A trial order will make you a life customer. Order from the above illustrations. "We can only stick you once." Try us with a 50c order. ALL GOODS PREPAID.

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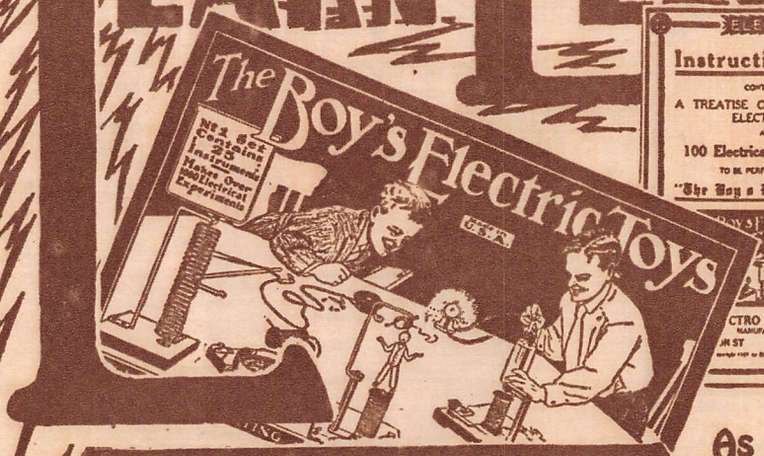
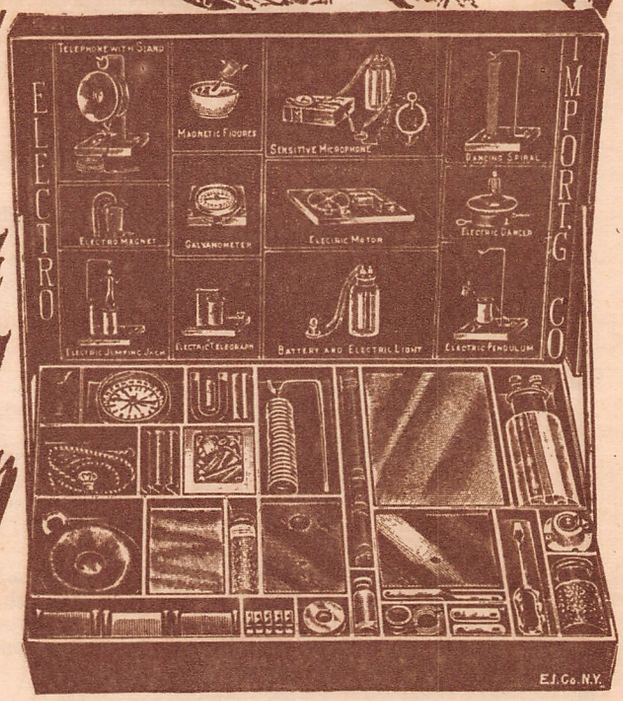


The BOY'S ELECTRIC TOYS



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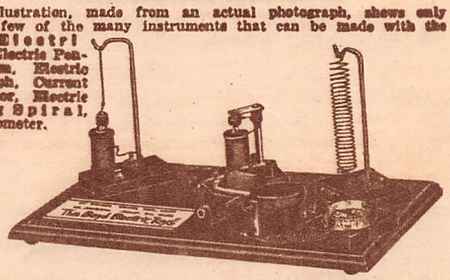
With each outfit we furnish free a very comprehensive book of electrical instruction. All the fundamentals of this fascinating science are clearly explained so even a layman can understand every word. Profusely illustrated. The instructions for building the apparatus are given in such a simple and easily grasped manner that anyone can make them without the least trouble. Over a hundred experiments that can be performed with the outfit are listed in the instruction book, nearly all of them illustrated with superb drawings.

A Sample of What You Can Do With This Outfit

This illustration, made from an actual photograph, shows only a very few of the many instruments that can be made with the Boy's Electric Toys: Electric Pendulum, Electric Telegraph, Current Generator, Electric Dancing Spiral, Galvanometer.



The outfit contains 114 separate pieces of material and 24 pieces of finished articles ready to use at once.

Among the finished material are included: Chromic salts, lamp socket, mercury, core wire, iron fillings, three spools of wire, carbons, machine screws, flexible cord, wood bases, glass plate, paraffine paper, binding posts, screw-driver, etc., etc.

Teaches You How To Build Electrical Apparatus

THE BOY'S ELECTRIC TOYS' contains enough material to make and complete over twenty-five different electrical apparatus without any other tools, except a screwdriver furnished with the outfit. The box contains the following complete instruments and apparatus which are already assembled:

Student's chromic plunge battery, compass-galvanometer, solenoid, telephone receiver, electric lamp. Enough various parts, wire, etc., are furnished to make the following apparatus:

Electromagnet, electric cannon, magnetic pictures, dancing spiral, electric hammer, galvanometer, voltmeter, hook for telephone receiver, condenser, sensitive microphone, short distance wireless telephone, test storage battery, shocking coil, complete telegraph set, electric riveting machine, electric buzzer, dancing fishes, singing telephone, mysterious dancing man, electric jumping jack, magnetic geometric figures, rheostat, erratic pendulum, electric butterfly, thermo electric motor, visual telegraph, etc., etc.

Shipment guaranteed within 24 hours.

SEND NO MONEY

We have so much confidence in this set that we desire to ship it to you C. O. D. with the privilege of inspection. It does not cost you one cent to take a good look at the outfit, and see if it comes up to your expectations. If it does, pay the postman $7.50, plus shipping charges. If it does not, you need not accept it, and we will pay the return charges as well.

THE ELECTRO IMPORTING CO.
231 Fulton St., N. Y. City

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231 Fulton St., N. Y.

As per your advertisement, ship to me at once, C.O.D., the Boy's Electric Toys with privilege of inspection. It is understood that if I do not like the outfit I can refuse it.

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(RN 2-22)

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Our service is mainly known from coast to coast, and from the Great Lakes to the Rio Grande. One reason is because we have a vast mail order department which considers it a pleasure as well as a duty to ship goods out the same day orders are received—the other reason is our large and complete stock insuring this prompt service. Take advantage of A. R. Co. service today. Below are a few suggestions.

"Magnavox R 3 Radio Telemegafone—the loud speaker that makes the home radio concert a success. No station complete without a loud speaker and here it is for **$45.00**

"Yale" 6 T. 60 Storage Batteries, 6 volt, 60 ampere hour rating. Best for filament lighting. **$18.00.** Also Radisco "B" Batteries at standard prices.

"Radotron" Vacuum Tubes.

UV 200 Detector-Amplifier (soft)	$5.00
UV 201 Detector-Amplifier (hard)	6.50
UV 202 5 watt Transmitting Tube	8.00
UV 203 50 watt Transmitting Tube	30.00

Murdock No. 56 Receivers. The New Murdock Receiver's construction is characterized by its firmness, strength and durability. Complete double set, 2,000 ohms, **$5.00.** Complete double set, 3,000 ohms, **$6.00.**

"Aeriola, Jr.," Crystal Receiver. An ideal receiver for the beginner in radio. Complete with tuner, crystal detector and double head set in special cabinet with hinged cover. Ready to connect directly to antenna and ground. Tuning average up to 500 meters. Receives Radiophone music. Price **$25.00.** With Antenna Equipment, **$32.50.**

Vacuum Tube Receiving Outfit No. 1
Incorporating the Westinghouse R. A. Tuner

Westinghouse R. A. Tuner	$68.00
Paragon Detector Unit	6.00
1 "Radiotron" U.V. 200 Detector Tube	5.00
1 Murdock No. 56 2,000 ohm Headset	5.00
1 Eveready "B" Battery	3.00
Storage Battery not included	$87.00

Distant radio telephone, amateur and ship stations may be received at any wave-length within its range of 170 to 800 meters.

The addition of the loading coil allows the reception of signals on 1,600 to 2,800 meters wave-length such as Arlington time.

Vacuum Tube Receiving Outfit No. 2
Incorporating the Westinghouse R.C. Tuner

Westinghouse R. C. Receiver	$130.00
3 Radiotron UV-201 Vacuum Tubes	19.50
Type C.B. Loading Coil	5.00
2 Cell "B" Battery, Eveready	6.00
1 W. E. Signal Corps Headset	15.00
1 Pacent Plug Adapter	2.00
Storage Battery not included	$177.50

Type R. A. Short-Wave Tuner, style 307,189, responds to a wave length of 180 to 700 meters and is especially selective. Type D.A. detector-amplifier, 307,190, combines a vacuum tube detector with a two-stage amplifier. Type R.C. combines type R.A. in one cabinet. Both units are mounted on Micarta panels attached to a polished mahogany cabinet. Simple in design, easy to operate, single tuning circuit; highly efficient.

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At the present time, with wireless at its highest ebb in public interest all over the country, radio enthusiasts are constantly looking for correct information regarding radio apparatus and parts. Realizing this the Atlantic Radio Company has prepared to take care of the best interests of this vast multitude. At all of our three stores, our salesmen are experienced wireless operators who understand the complete stock they are selling and are anxious and cheerfully will help you to get the best possible results from your investment in radio. Because you cannot personally visit our stores is no drawback. Our mail order department is noted for its prompt and accurate service to all parts of the United States, Canada and scores of foreign countries.

When your friends newly interested in the wireless telephone ask you for advice tell them about Atlantic Service. Bulletin 14 and special broadcasting literature sent on request to the readers of Radio News and their friends.

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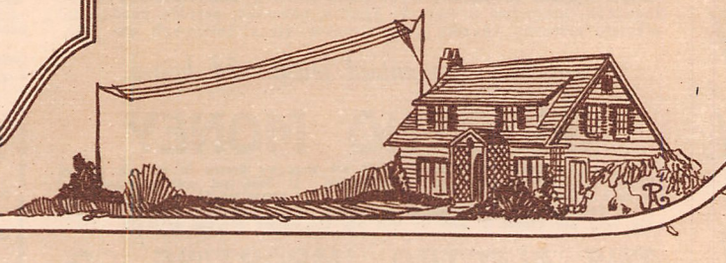

tors in the interest of simplicity of operation. The hot wire ammeter makes known to the operator whether or not signals are radiated.

This type of transmitting outfit has a potential strength of 200 watts. This somewhat high power was gauged by the practice of the French army in employing powerful airplane radio telegraph sets. When these allied armies were operating along the same battlefronts, the use of less powerful equipment by the American forces would have rendered ineffectual their signalling due to interference from the French airplane radio appliances. Another influence operating toward the use of high-power apparatus was the possibility of employing a fixed antenna on aircraft, an arrangement which would involve a greater energy input than that required for the trailing antenna for equivalent radiation. The specially designed inductor generator had a capacity of 4500 revolutions a minute. Otherwise, it had a rating of 116- to 126-volt on open circuit, 900-cycle 200-watt generator. The stator is made up with four direct current poles, four slots being cut into each of these for the reception of the high frequency alternating current windings. The rotor has a dozen teeth, this unit acting as an inductor. The slots between the teeth invite the placement of the direct current winding for exciting the electrical field. The commutator, located on one end of the rotor, conveys the direct current to the field coils. One side of this circuit is carried to a distributing block to facilitate connection in a field switch and a dry battery which is employed as an aid in exciting the field. The battery is only a temporary accessory, the abandonment of which will be authorized when experience has proved that the field can be duly excited in the absence of the impulse of the moment from a battery. In actual rotation, the dozen teeth, referred to above, pass the alternating current windings and vary the flux through 12 cycles for each revolution. The frequency of the generator at the rated speed of 4,500 revolutions a minute is, obviously, 900 cycles a second.

The generator receives its impetus from a 20-inch two-blade air-fan, the latter functioning at a practically unchanged speed even when subjected to wide variations of air movements. A centrifugal governor, mounted at the center of the fan inside the housing, varies the pitch of the air-fan blades to harmonize with the fluctuations in air velocity. So effective is this control that the speed of the generator is maintained within a plus or minus four percent of 4,500 revolutions a minute, although the atmospheric movements vary from 50 to 175 miles an hour. The radio telegraph transmitting outfit will function satisfactorily with the power output corresponding to a speed as low as 4,000 or as high as 5,200 revolutions a minute, a condition affording the governor control effective operating limits. The pitch of the air-fan blades is varied by use of two weights, one attached to each arm, the positions of which are controlled by centrifugal force. The centrifugal action of the weights is counteracted by compression springs. When the spring reaction and the weight on the arms are properly adjusted, the position of equilibrium between these two contrary forces is such as to insure the speed of 4,500 revolutions a minute, when the wind rages at a speed varying from 50 to 175 miles an hour. The rotation of the air-fan blades about their axes, as the governor varies the pitch, is effected on ball bearings at each side of the housing.

The rotary gap determines the tone of the signals transmitted and, in a measure quenches the spark. This unit is comprised of a rotary brass disc constituting one elec-

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New Moulded Variometer
With Bronze Spring Connections

Their correct weight renders screws unnecessary for table operation—four screws supplied for panel mounting. Type for Grid and Plate, each **$6.50**

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Designed to accompany our Moulded Variometer. Primary adjustments are varied in units of 1 and 6 turns respectively. They are standard equipment with discriminating users everywhere, each **$5.00**

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New Style detectors and amplifiers, used alone or interpaneled. Their neat appearance and operating efficiency have gained instant popularity.

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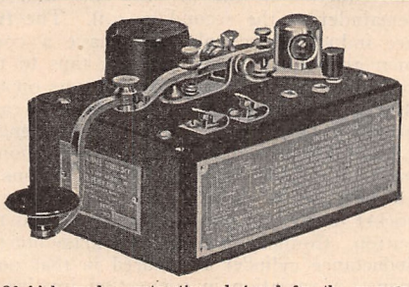

Of high grade construction, designed for the purpose of instruction in audible or visual signals, with the International or other codes based on the dot and dash principle. It is scientifically made for efficiency, simplicity, compactness and durability.

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A model of perfection and all-around utility, officially adopted by the U. S. Army Air Service, U. S. Marine Corps and Navy Department Bureau of Steam Engineering. It is a self-contained unit, and may be operated on the table, in the lap, or in any position desired. Note detachable arm.

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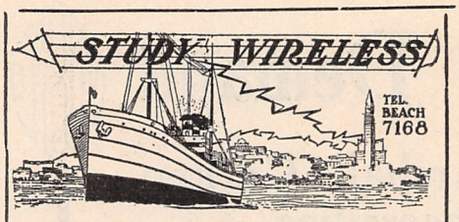

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	250 ft	500 ft.	1000 ft.
Wesco Antenna Wire 7-22 Stranded Copper	$1.80	$3.50	$6.90
No. 14 Solid Copper	1.15	2.00	3.75

Wesco Magnet Wire—½ lb. Spools B and S, Ga.	Enam.	S.C.C.	S.S.C.
20 to 24	$.55	$.65	$.90
26 to 30	.65	.95	1.30
32 to 36	.80	1.40	2.15

No. 23 Single Silk Covered, 90c per ½ lb. spool.

Genuine Bakelite Panels—⅛ inch thick

6 in. x 10½ in.	$1.30	8 in. x 14 in.	$1.50
6 in. x 14 in.	1.50	12 in. x 14 in.	3.25
6 in. x 21 in.	2.25	12 in. x 21 in.	4.75

For 3/16 in. thickness add 50% to above prices.

Wesco C.W. Inductances for 5 and 50 watt tubes. 30 turns No. 11 square copper wire, 6 in. bakelite tube, base and clips, complete at..... $8.50

Wesco Detector Panel, with tube $10.50

Wesco Amplifier Panel, with tube 16.00

"SPECIAL"—6 volt—60 to 80 Amp. hr. Batteries guaranteed for two years $15.00

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The Vimy Supply Co.

567 College St., Toronto

trode of the gap, and a piece of tungsten forming the fixed electrode of the gap. The disc is mounted on an insulating hub, the latter being keyed to the shaft of the alternator. The stable tungsten electrode is mounted in an insulating block and secured in place by an adjustable bracket, which, in turn is clamped to the hub of the alternator. Five interchangeable discs lend versatility to the transmitting radio telegraph set. These are equipped with 6, 9, 12, 17 and 24 teeth, respectively, and afford corresponding tones of 450, 600, 900, mixed tone, and 1,800 sparks a second. The installation of any one of these discs involve two adjustments, namely, angular and radial arrangements of the stationary electrode. The first of these adjustments determines when the spark will occur with reference to the cycle of the generator voltage, while the other one makes known the length of the gap between the stationary electrode and the rotating teeth as they pass. The stream-line casing employed in rigging up the transmitting set is constructed by molded canvas and bakelite. It is affixed to the generator by use of a bayonet joint and catch in the steel reinforcing band. Heat and gases produced by the spark are expelled through ventilating holes perforated in the housing. Having mounted the generator, the location of the stream-line is such that one of the ventilating holes is at the side behind the mounting bracket of the generator, where the air current has a tendency to draw the breeze into the housing. The other ventilating hole, at the side of the casing, is in the free path of the current. It thus produces a suction, with an inclination to expel the air from the housing. The two openings are responsible for a stream of air flowing through the hemmed-in quarters which assists in quenching the spark at the spark-gap.

The power transformer for stepping-up the voltage furnished by the alternator and the condenser in the closed oscillatory circuit form side-by-side companionship in the generator stream-line. They are secured in position by two bakelite insulating discs which are clamped together by means of fibre rods. The transformer is of the closed-core design, having its primary coil wound on one leg and its secondary coil wrapped around the other leg of the core. The condenser employs mica as a dielectric, having a capacity of .004 microfarads. It is mounted in an open aluminum frame and is coated with a preparation designed to ward off moisture.

The oscillation transformer is built of a solid bare copper wire, wound in grooves around a hollow bakelite cylinder. The latter is secured to a disc of like material which is mounted on a short shaft held in the insulating frame of the radio transmitting outfit. A portion of the turns of the coil function as the primary unit and the remainder as the secondary coil. The two are inductively coupled and have a common grounding. Nine primary taps to the coil are projected to contact buttons on the disc at the front end of the coil and each button is identified with the wave-length of the closed oscillating circuit corresponding to it. Connection with these buttons is effected by a spring contactor having a socket in the end which snugly envelops the button. Connection is not only made but the inductance cylinder is secured in that position. A variation in connection involves a pulling of the spring contact toward the fan and the entire inductance cylinder set in motion until the button sought after faces the spring contact.

The seven secondary taps on the oscillation transformer are related to the contact buttons on a disc at the back end of the

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cylinder and connection is gained with the different buttons by a simple lever switch, the latter pivoting about the axis of the cylinder. The secondary turns of this transformer are incorporated in the open oscillatory circuit or antenna circuit. A changing of the number of turns by means of a series of taps labeled A, B, C, etc.; it is possible to vary the volume of power transferred from the primary to the secondary windings and hence the quantity of energy radiated between the range of normal and one-sixteenth normal output. The least energy is available when the switch is opposite tap A. The output current is conveyed from this coil to the antenna through a special coil spring and socket connector in the point of the casing which bears on a metal post in the center of the disc at the back end of the oscillation transformer cylinder. This flexible connection facilitates a removal of the casing to effect wave-length and tone adjustments without disturbing the relations running from the casing to the variometer.

The variometer—serving the purpose of tuning the antenna circuit to the wave-length of the closed oscillatory circuit—is installed, together with a hot wire ammeter, in a wooden box. The latter is mounted in the airplane fuselage between the two cockpits conveniently accessible to the observer for making adjustments. The instrument has an inductance, varying between .035 and .40 millihenrys. The variometer is composed of a cylindrical coil of solid copper wire wrapped around a hollow cylinder of a light insulating substances. Variation of inductance is obtained by use of a trolley fixed within the coil which moves parallel to the axis of the latter, and comes in contact with the bare turns of the wire as it passes. It can thus be made to cut out or in with one turn of wire at a time as it is moved along. The trolley receives its moving impulse from a handle on the cover of the box which revolves a pinion engaging with a racket on which the sliding trolley is fastened. The unhampered end of the coil is so identified with the circuit that a break in the trolley contact would insert the full coil in the former and not interfere with its functioning. A brass disc proceeding with the trolley inside the coil is an agency for insulating or short circuiting the magnetic lines of force, a safeguard against losses in the short circuited coils. Likewise changes in inductance are prevented from being so abrupt. The eddy current wastage in this disc is not worth mentioning. This variometer runs the gamut of the whole range of wave-lengths or frequencies without any change of connections. Rotation of the handle clockwise increases the wave-length, while the opposite movement or counter-clockwise, decreases the frequency. The hot wire ammeter, forming companionship with the variometer in a box, is protected with a glass window so that the meter case—maintained at high potential—is not within contact of the operator. The meter, reading from zero to 2.5 amperes, is oblivious to the vibration of the airplane in its orderly performance.

The sending keys, three in number, are of the flame-proof design, being heavy in construction and provided with an adjustable gap. A bayonet kind of socket for a winker lamp is mounted on the base of each key and a spun metal cap offers protection. The lamps, specially designed, are 130-volt Mazda type, arranged in parallel with the key. Thus a lamp is on when the key is open and off when the latter is closed. Its services are twofold. The brilliancy of the filament is a sign as to the voltage being expended by the generator and also indi-

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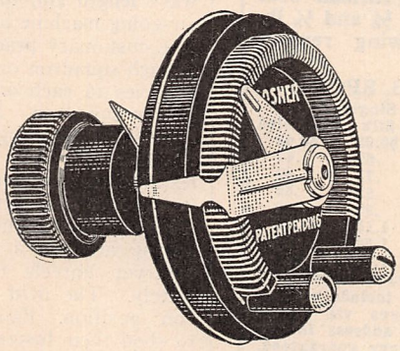
Patent  Pending

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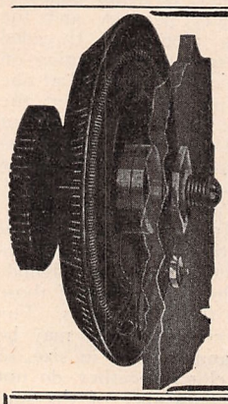

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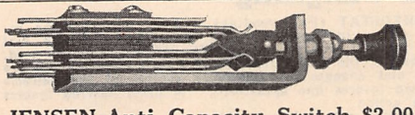

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cates to the pilot or observer when someone is sending signals so that an outsider will not tamper with the key and cause interruption. Also the operator obtains some assistance in correctly sending the code by the convenience of a visual indication of the spacing of the dots and dashes.

In actual service, the type SCR-73 airplane radio telegraph transmitting set does not lend itself to confusion as a specified wave length and tone are assigned to each air-going machine before it leaves the earth. The customary practice is to allot one note to each squadron or flight and different frequencies to each aircraft unit of this particular squadron. Specific instructions are issued for installing the wireless apparatus. A table has been prepared indicating the length of the antenna in feet to be employed in ratio to the wave-length in meters and the power tap for miximum radiation. Once having attained a reasonable altitude, the observer unreels the antenna wire completely. The field switch is closed in the "on" position. Failure of the winker lights to shed their luster is a sign that the generator field has not been built up. Hence the field switch is closed for the moment in the "battery" position and then reassigned to the "on" location. The lamps then glow, a token which may be accepted that the equipment is connected properly and is ready for business. The final injunction of the instructions is to press the key and turn the variometer handle until the hot wire ammeter reveals the maximum radiation. This having been attained, the antenna circuit is in tune and the transmitting set is ready for service at the word "Go."

Junior Radio Course

(*Continued from page 714*)

positive is developed so that the dots appear in relief as shown in Fig. 1A, and is then fixed around the cylinder A of the transmitting apparatus, which rotates. The needle B presses slightly upon the positive and moves forward along the cylinder as the diaphragm of the old-type phonograph did, advancing slowly as the threaded shaft C rotates. For each turn of the drum A, the needle B is moved the thickness of the needle, so that the entire surface of the cylinder is covered by the needle, making contact only when it touches one of the points of the positive mounted upon the cylinder.

Each time the needle comes in contact with a point, a signal is sent by the transmitter; this signal, received at the station shown in Fig. 2, operates the relay R1, which closes at the contact K1 the circuit, in which is inserted a small electro magnet mounted on the moving element of the reproducer, of the same type as the transmitter. In the reproducer, a white paper is wrapped around the cylinder A and the moving piece sliding along the threaded shaft C, supports a small arm pivoting on the axle F and to which are attached at one end a small iron armature D and at the other a pencil or pen B1. When the circuit is closed by a signal sent from the transmitter, the electro magnet E attracts the armature D and the arm pivoting at F, makes the pen mark a dot on the paper.

This system of transmission does not give many details, although the pictures reproduced are much better than in the Knudsen system, having the appearance of those that may be seen in the newspapers. For better details, the received picture may be photographed again and reduced in size, so that the dots, being closer together, do not show a broken-like appearance of the surface of the picture.

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ments, is still crude, but good results were obtained for drawings in black and white only.

In the next lesson will be described the more modern instruments using selenium cells with which it is possible to send the half-tones of photographs.

Wireless Telegraphy in Japan

(*Continued from page 713*)

control of Dr. Asano of the Tokyo Imperial University, and he may well be called the pioneer of wireless telegraphy in Japan. He has to his credit several inventions and improvements, the most important being the Tushinsho Wireless System. This system is used almost exclusively on Japanese ships and at coast stations, and is known to be highly efficient. In addition to this, the Doctor also holds the distinction of being the first Japanese to lay a long distance submarine cable; this was laid between Formosa and Osumi. It was through his experiments that the value of wireless communication was conclusively proved to his nation during the Russo-Japanese war.

Dr. Asano is the most outstanding figure among Japanese inventors, in fact, there are only a few of his country's inventors who study wireless theory, and none of them have contributed on as large a scale as he. The Doctor holds the office of Superintendent of Wireless Telegraphy and Cables, also of all electrical works in Japan. The first commercial station to be erected in Japan, was put in operation in 1908 at Choshi, which is near Yokahama. The purpose of this station was to communicate with ships at sea.

In 1915 a wireless service between Japan and the United States was effected, the terminal stations being Funabashi near Tokyo and San Francisco, California. The messages were relayed through Honolulu. The completion of this Trans-Pacific service was celebrated by an exchange of messages between the President of the United States and the "Mikado" of Japan. Later, in the same year a commercial service between other foreign countries and Japan was inaugurated, the route being via Otchishi and Petropavlovsk in Siberia.

In the year 1918, a station at North Sydney, Australia, by the use of a very sensitive receiving apparatus, was able to read signals from the station at Funabashi with perfect ease. In the same year, by a special arrangement made between the two Governments, two messages were exchanged between Carnarvon, England, and Australia, a distance of 12,000 miles. The signals transmitted at Carnarvon were received practically instantaneously at the Australian station, and with great success.

Since the erection of the Choshi station in 1908, the number of stations in Japan has so increased that in 1919 there were no less than 62 Government and 53 private stations in operation. In addition, there are a great many stations that belong to the Army and Navy. All Government stations are controlled by the Ministry of Communications, which also, from time to time, inspects the private stations.

Japan's first wireless regulations were established in 1900; these were improved upon and a number of additions made, until the present Japanese radio-telegraphy law came into use in the year 1915.

The Japanese student has a lot more to go through in order to become an efficient Radio operator than we in America do. He must have a thorough knowledge of the English language, which in itself means hard study, for more than the unfamiliar Japanese. At least, I do not think we would have half so many wireless operators in this country if the examination papers stated that they must be able to transmit at a speed

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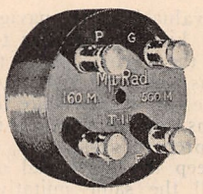

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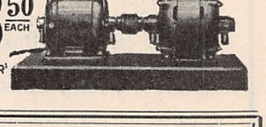

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of not less than 20 words a minute in both the English and Japanese languages. On account of the long training they must undergo to obtain this skill in the two languages, the Japanese are extremely good operators from the time they first start professional work. The Japanese operator is under a penalty of two years' hard labor, or a fine not exceeding 500 yen, for divulging secret messages. Operating a ship's station on the Japanese coast is not the most pleasant of pastimes, especially if the operator in question has a hasty temper and a few messages to put through. The Japanese operators seem to be extremely busy at all times. All work done between their own stations is transmitted in their own language so with all their work it is hard for one to say whether they are really busy, or just holding conversations. Add to this the interference of so many other stations working in the vicinity, and the excessive atmospheric electricity, generally known as "static," which becomes so evident during the typhoon season. The wireless antenna collects this static and runs it to earth through the phones, producing a series of loud clicks. The telephones are so sensitive that this noise often drowns out all signals, thus making it impossible to work with any other station that is not within a radius of about 50 miles. This "static" or so-called "terror-of-the-air," is more in evidence when in the presence of an electrical storm and especially a typhoon. The station at Choshi every day at 9:00 p. m. sends out time signals. The time 9:00 p. m. at Choshi is equivalent to 12:00 noon at Greenwich; therefore it is very useful to navigators in checking up their chronometers. Immediately after sending "time," the above station transmits "Typhoon" and "Depression" warnings, giving the position in longitude and latitude of the storm centers at a stated time of day, also the barometer readings of storm centers and the direction of travel.

All this is invaluable to the navigator, and tells him what kind of weather to expect. For instance, if the warning places the storm center near his position, and traveling in his direction, he can at once take the necessary precautions, and as a whole is always in a state of preparedness. We, as a nation, cannot keep too far ahead of Japan, for she is still the same imitative nation that she was of old.

Radio Digest

(*Continued from page 707*)

prizes respectively. All three prize winners are licensed amateurs. Both 1CJR and 1BYL are sophomores in high school.

Mr. Cox receives two "Basketball" Variometers and one "Basketball" Vario-Coupler. The second and third prizes are, respectively, one "Basketball" Vario-Coupler and one "Basketball" Variometer.

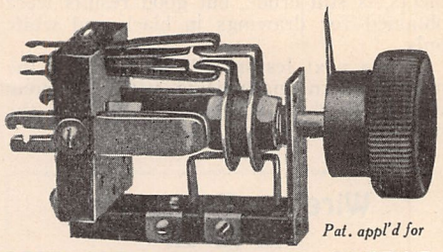
The award in the Receiving Set Name Contest has been delayed by the Committee. The contest as a whole was declared very satisfactory. Several hundred names were submitted, nearly every State in the Union being represented.

Radio Telephone Development in the West

(*Continued from page 709*)

Then in quick succession phones sprang up in Oakland, an adjacent city to San Francisco; at the Hotel Oakland, operated by the Western Radio School: the station at Los Altos, operated by the Colin B. Kennedy Co.; the Radio Shop of San Jose, and another one in Oakland operated by Warner Brothers, dealers in that city.

Until very recently concerts and press news were broadcasted on various wave-



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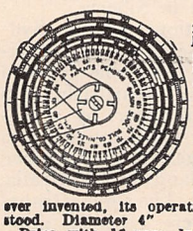

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lengths, and all one had to do if he did not like the record that one station played, was to give the variometers a twist and another station would come in.

But all this has stopped. A new Government regulation compelling all phones and C.W. stations to operate on a wave-length of 360 meters has been passed. Then all the radiophone men assembled and had a pow-wow about the schedules. So they finally fixed it up so they would not interfere with each other.

Now one can receive press, weather, market reports, and concerts in the afternoon from 4:30 to 5:30 P. M. and at night from 7:10 to 9:00 P. M. During this time several stations would be operating in turns.

The old California Theater station was taken over by the Atlantic-Pacific Radio Co. which is going to remodel the set to work on 350 meters.

Several months ago we had quite a treat from the Fairmont Hotel in the form of a concert rendered by members of the Scotti Grand Opera Co., which was giving performances in San Francisco at that time.

Also, at frequent intervals, lectures are broadcasted from the Presidio. They are on radio topics of general interest and are very instructive.

It is very interesting to note the increased efficiency of the stations as time progressed. At first the California Theater used nearly one kilowatt, and obtained about 4 amperes radiation. Later the Fairmont Hotel, which uses a great deal less power and secures only a little less than ampere radiation, comes in from two to three times louder.

A Combination Universal Receiver

(*Continued from page 715*)

so that any external tuner can be tried by disconnecting the bars from K to M and S to N, and the leads of the tuner to be tried connected to K and S.

The receiver oscillates on 10 volts "B" battery, and it does not require more than 35 volts at the most. Experiments show that the circuit used requires less "A" and "B" batteries, compared to other circuits.

By using this receiver all of the local (Hawaii) stations were copied, and ship stations over 1500 miles were copied. With one-stage amplifier, some of the stations of the mainland of America were copied also, with signals fairly loud and clear.

Magnetic Modulator for Radio Telephony

(*Continued from page 695*)

distorting method of controlling the output of a single tube for radio telephony. Furthermore, it permits the parallel use of a number of tubes as oscillators and thus eliminates the use of special modulator tubes with their necessary additional accessories and critical adjustments.

This modulator in many respects is similar to the well-known Alexanderson magnetic amplifier, except that the latter is operated as a variable impedance connected across the alternator while the Magnetic Modulator functions merely as a series variable resistance in the antenna circuit. Since the modulator provides a linear control of the antenna current and functions with very small values of control current such as those flowing in the ordinary low resistance microphone transmitter, it is an ideal modulation device for purposes requiring the control of radio frequency energy at short-wave lengths, such as is demanded in amateur radio telephony.

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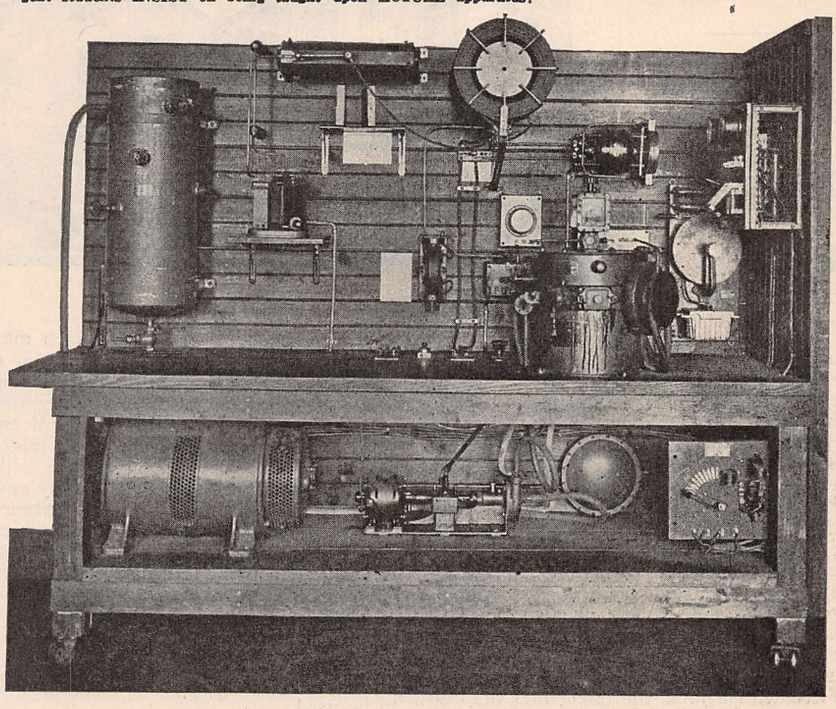

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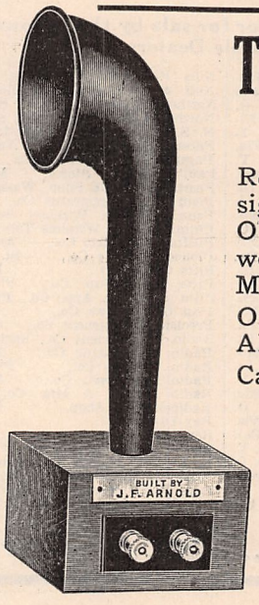

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The detector and amplifier units, which may be built from this set of patterns, may be used with any type of regenerative receiver, or long wave set, using honeycomb coils or any other form of inductance for tuning. Only those who built the short wave regenerative set of this series of patterns, can appreciate the simplicity and ease of construction of these new instruments.

If, to the short wave set, which may be built with the set of patterns No. 1, are added a detector and two amplifying units, the receiving outfit thus composed will give wonderful results and will enable the owner to operate a loud talker for the entertainment of his friends with radiophone transmissions, which may now be received every day. The appearance of the complete receiving outfit, which may be built with these sets of patterns, is as attractive as that of any standard make of apparatus, and its functioning is as good and we may say, in several cases, better.

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The Development of Radio Telephone Communications Between Lifeboats and Shore Stations

(Continued from page 694)

signals varied in intensity, disappearing completely at two points. Each of these points of extinction (180 degrees apart) covered an angle of approximately 10 degrees when the boat was at a distance of about five miles from the land station, and are therefore not objectionable since the boat would not, in rough weather, hold a course steadily enough to keep within these limits. Furthermore, the more powerful the transmitting apparatus on the boat and the more sensitive the receiving set on land, the smaller this angle of extinction. This feature is, therefore, not as objectionable as might be expected.

Further tests were conducted with the boat five miles at sea in fairly rough water. These tests showed that even with the low-power radio telephone transmitting sets used, it was possible to maintain communication up to a distance of five miles with the engine running. The motion of the boat and the waves did not alter the transmitting wave-length. This probably would not have been true had a coil of two turns been used instead of a single-turn coil.

On November 16, 1921, a demonstration of this method of radiophone communication was given before the Life Saving Board of the U. S. Coast Guard which was at that time holding a meeting at Atlantic City. During this demonstration, two-way communication was maintained up to a distance of five miles. Members of the party went out on the lifeboat and were able to talk with those who remained ashore, with perfect ease. Incidentally an airplane which was passing over the boat was easily heard by those listening at the land station.

CONCLUSION

As a result of these tests it may be stated that radio telephone communication between a Coast Guard lifeboat and shore is practical and should prove a valuable addition to the boat equipment. While the radio apparatus used in the tests was not well adapted to the purpose, it is merely a matter of detail of construction to make a radio telephone set which would be water-proof and of power and wave-length suitable to meet the specific need. The coil aerial as used was satisfactory for permanent use.

It is suggested that a practical radiophone set for a Coast Guard lifeboat should consist of at least three or four 5-watt electron tubes operated in parallel. Tubes requiring a plate voltage of not over 400 volts are desirable. If it is possible to obtain a 25 watt tube requiring 500 volts or less for the plate voltage this would be preferable. It is not advisable to use a tube requiring more than 500 volts on the plate on account of insulation difficulties in the generator and other parts of the circuit. Storage cells must be used as a source of power. These may be charged from a generator coupled to the engine on board the boat.

The radiophone sets should be designed to operate on approximately 1,000 kilocycles

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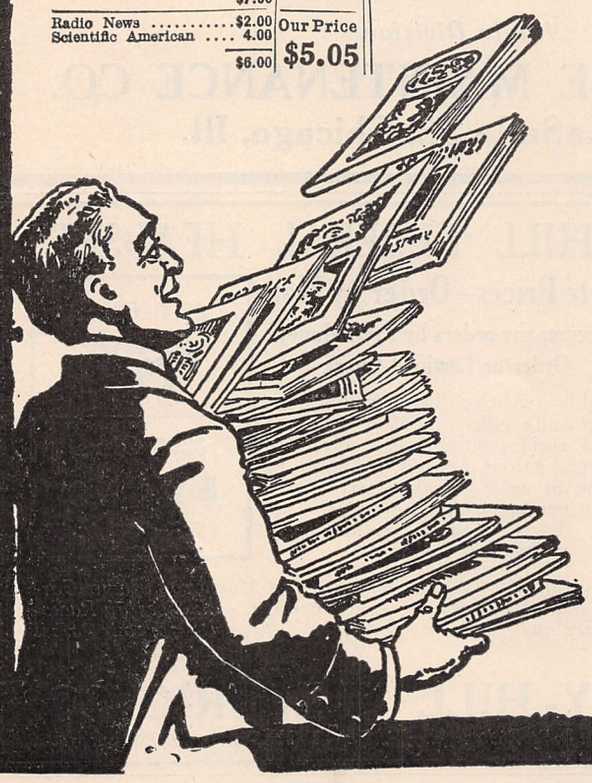

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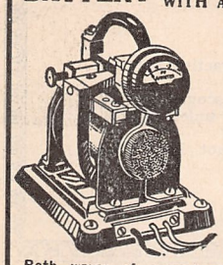
10c CHARGES YOUR STORAGE BATTERY AT HOME WITH AN F-F BOOSTER



So You will never have to give up in disgust when working a distant station. Is it not gratifying to feel that all the year round your Filament Battery will be ready when you want it? You know what it is like to have friends call to "LISTEN IN" and then find your battery dead. F-F BATTERY BOOSTERS charge Automatically and Operate Unattended. Screw plug in lamp socket, snap clips on battery terminals and see the gravity come up. Both waves of current are rectified thru adjustable and easily renewable carbon electrodes, which maintain a constant efficiency and last for thousands of hours. Also charges batteries right in Autos. No skill required. AMMETER shows you the amount of current flowing. EVERYTHING COMPLETE IN ONE COMPACT, SELF-CONTAINED, PORTABLE CHARGING UNIT. F-F Battery Boosters are Magnetic Rectifiers for 105-125 Volt, 60 Cycle, Alternating Current. PRE-WAR PRICES
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The Larger Types are for heavy batteries, or where time is limited. Shipping Weights 12 to 15 Pounds. Order from your Dealer or Send Check for Prompt Express Shipment. If via Parcel Post have remittance include Postage & Insurance Charges. Or have us ship Type desired C.O.D. Other F-F Battery Boosters Charge Batteries from Farm Lighting Plants & D. C. Circuits. For GROUP CHARGING use our Full Wave, Automatic F-F ROTARY RECTIFIER of 100 Volt, 36 cell capacity.

Order Now Or Write Immediately for Free BOOSTER Bulletin No. 32 or ROTARY Bulletin No. 32A.

THE FRANCE MFG. CO., OFFICES & WORKS: Cleveland, Ohio, U.S.A.
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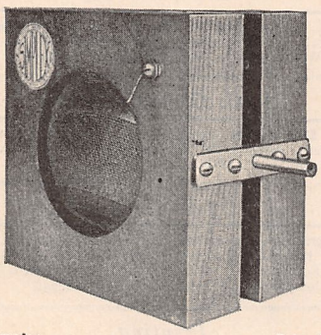

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SPECIAL FOR FEBRUARY

7 Strand Phosphor Bronze Aerial Wire per 100 ft.	$2.00
Assembled Regenerative Receiver	35.00
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Amplifying Transformers	3.50
Double Circuit Jacks and Plugs Complete	1.50
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NEWARK WIRELESS EXCHANGE
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TUBING, WIRE, BUSHINGS, PANELS
Buy ALL Parts for Consolidated Radio Patterns from the
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Complete set of curves and tables giving wave length ranges of coils of various numbers of turns with different tuning capacities. Charts covering 0 to 3600 meters, 50c.; 3600 to 24000 meters, 50c.

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(300 meters), since at this wave-length difficulties from interference from other radio transmitting stations will be a minimum. The complete outfit should be made waterproof.

For receiving, an amplifier consisting of three stages of radio-frequency amplification, a detector, and two stages of audio-frequency amplification should be used. It should be designed to be especially sensitive at 1,000 kilocycles (300 meters). Receiving should be done by throwing a suitable switch which should connect this amplifier and a 0.002 microfarad variable condenser in parallel across the coil aerial. For greater selectivity coupled circuits may be used.

The coil aerial should be similar to the coils Nos. 1, 2 or 3 mentioned above. In case the keel is used, as part of the coil circuit, care must be taken that all joints are well connected electrically throughout.

The land station should consist of a 50-watt, 1,000 kilocycle (300 meter) radiophone transmitting set of reliable make. For receiving, a selective tuner designed for use at the same wave-length should be used in combination with an amplifier similar to the one used on the boat.

Dictionary of Technical Terms Used in Radio

(*Continued from page 714*)

Rays (X Rays), etc. When a high potential is created in rarefied gas the discharge does not take place in form of a spark, but in a more steady flow of electrons. The color glow seen in a vacuum tube during its excitation is due to Cathode rays striking on the glass walls of the tube. See Geissler Tube.

Valency—Number of atoms of Hydrogen which one atom of an element is capable of generally replacing or displacing.

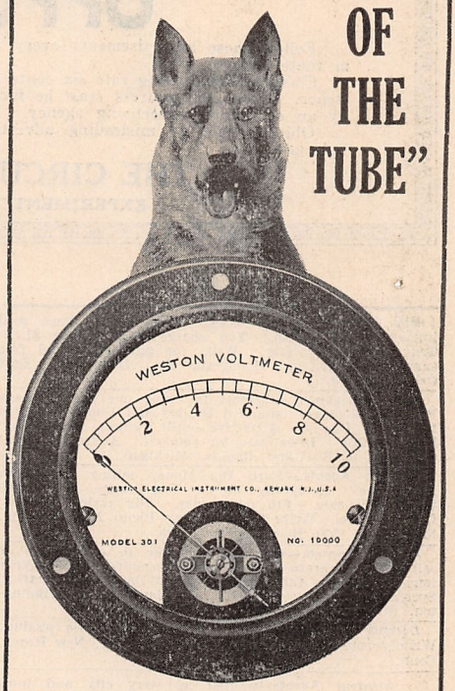
Valve Amplifier—A three electrode vacuum tube of the Audion Type comprising an incandescent filament, a grid, and an outer plate, sheath or wing connected to the positive terminal of an auxiliary battery usually of between thirty and two hundred volts. The currents to be magnified are led to the grid, and by a trigger action upon the electrons passing from filament to plate cause these currents to be repeated with increased amplitude in the plate circuit, the extra energy being furnished by the auxiliary high tension battery. The tube may be employed to amplify either the incoming frequency oscillations, or the audio frequency currents after rectification, or both rectification and magnification may be performed by the one tube.

Valve Detector—Depends upon the unidirectional conductivity between a hot and cold electrode in a rarefied gas, that is a rarefied gas permeated with negative Ions. A tungsten or carbon lamp in which a cylindrical metal sheath surrounds the filament, is placed in an oscillating circuit, one end of which is connected to sheath and the other to filament through a potentiometer. When filament is made incandescent, by a local circuit, the received oscillations are rectified into unidirectional currents capable of working phones. This is due to fact that during incandescence space between filament and sheath becomes conductive, in one direction only. Phones require a great number of turns. usually of about two or three thousand, sometimes even more Ohms.

Valve Oscillator—A Reaction of Regenerative circuit so arranged and adjusted that the coupling between plate and grid circuits is sufficient to maintain a continuous interaction. The tube then gen-

(*Continued on page 791*)

"THE WATCHDOG OF THE TUBE"



This announcement is of vital interest to every Radio Amateur who desires to

(a) Obtain the best possible results from his tubes, and
(b) Secure maximum life with minimum replacement of his tubes.

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is a name known all over the world, wherever electrical measuring instruments are used. Weston Instruments are the universally accepted *standards* of precision and workmanship. The founder and president of this company, Dr. Edward Weston, originated the art of electrical measurement as it is practiced today, and he and a staff of the most expert instrument engineers have been constantly perfecting Weston Instruments for the past thirty-three years. This Company has thus contributed practically every improvement or advancement to the art.

The price of Weston Instruments, because of their quality of workmanship, is necessarily a trifle more than the prices established by other instrument manufacturers, but is very little more than the cost of a new tube.

The Weston line of Radio Instruments comprises Voltmeters, Milliammeters, Ammeters and Antennae Ammeters. There are Weston Instruments for every Receiving or Transmitting requirement.

Whether you prefer to use an Ammeter for controlling the filament current of your tubes, or whether you are following the later practice of filament voltage control, you can procure a suitable Weston Instrument at slightly more than the cost of a single tube.

The use of a Weston Voltmeter for filament voltage control should prolong the life of your tube very greatly, sometimes 300 per cent.

East Weston Instrument will last a lifetime, with reasonable care, and will provide a constant means of proper regulation for receiving, amplfyng or transmitting tubes.

Tell your dealer you want a Weston Instrument and write to us for Radio Circular "J". If your dealer cannot immediately supply your needs write to us, giving his name and address, and we will supply you. Address

RADIO DEPARTMENT

Weston Electrical Instrument Co.
173 Weston Ave., Waverly Park, Newark, N. J.

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Follow these advertisements every month. Reliable advertisers from all over the country offer you their most attractive specials in these columns.

Classified advertising rate six cents a word for each insertion. Ten per cent discount for 6 issues, 20 per cent discount for 12 issues. Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency. No advertisement for less than 10 words accepted.

Objectionable or misleading advertisements not accepted. Advertisements for the March issue must reach us not later than February 10.

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Agents Wanted.—One live amateur in every town to sell radio apparatus. Attractive discounts given. Write immediately for full particulars. Wilmington Electrical Specialty Company, Dept. C, 705 Adams Street, Wilmington, Delaware.

District Managers Wanted to sell automobile product. Write Jarmie's Mfg. Company, 109 Lloyd St., New Haven, Conn.

Amateur Agents wanted in every city and town to sell radio apparatus. A few stocking agencies still open. Delfelco, 12 Meeting Street, Pawtucket, R. I.

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Model Aeroplanes that Fly.—Buy your complete outfit, scale drawings, fittings compressed air motors and all-best model aeroplane supplies from the Wading River Manufacturing Co., Established 1900. Our new 52-page catalog illustrated, 24 latest models and designs. Send 5c for your copy. Wading River Manufacturing Co., 672 J Broadway, Brooklyn, New York.

Books.

Handbooks for Electricians and Experimenters, 20c. Joe Tillberg, Proctor, Vermont.

We Buy and Sell back issues of Radio Amateur News and Electrical Experimenter. Boston Magazine Exchange, 109 Mountfort St., Boston, Mass.

"Schemer Magazine," Alliance, Ohio, prints big profit schemes; one subscriber making 25,000 from three; another 10,000 from one. Try your luck. Year, only $1.00; three months, 25c.

Ecstatic Seer Stigmasee Emmerich, Nativity, Egypt, Cana; 4 books, for 20c. Klein Co., Brandon, Minn.

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Radio Storage Batteries.—6 volt 40-60 amp., $10; 6 volt 60-80 amp., $12. All brand new and guaranteed. W. & G. Tufts, 336 Newbury St., Boston, Mass.

Four Bargains in Edison Storage Batteries. 2—6-volt 150 ampere hours, $24 each; 2—6-volt 225 ampere hours, $29 each. Fully charged, F. O. B. New York. (These batteries can be charged anywhere for the same cost as a 40 ampere hour battery, and have four times the capacity). Also have some Edison elements for "B" Batteries at 10c per set. A. J. Hanks, 608 Montgomery St., Jersey City, N. J.

Storage Batteries, 6 volt, 15 amp, $3; 40 amp., $6; 120 amp., $10. Also batteries for farm lighting. H. W. Barraclough, 3649 N. Tenth St., Phila. Pa.

Wright Radio "A" Batteries. See ad page 744.

Business Opportunities.

Advertise. Country town newspapers: List free. Pennell Company Covington Kentucky.

Discover yourself. Find your true career by Chart based on recognized scientific laws. Free booklet D. Bolger Vocational Service, 296 Broadway, New York.

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Learn Chemistry at Home—Dr. T. O'Conor Sloane, noted educator and scientific authority, will teach you. Our home study correspondence course fits you to take a position as chemist. See our full page ad on page 773 of this issue. Chemical Institute of New York, 140 Liberty Street, New York City.

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Correspondence Courses at less than half original price. Any school; any subject for men or women. Bulletin 1074 free. Courses bought. Instruction Correspondence Exchange, 1966 Broadway, New York.

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Crystal Gazing Globes. Otto Waldman, 1450 First Ave., New York.

Tricks, Jokes and Puzzles. Get our catalogue first. Agents Supply House, Binnewater, New York, Dept. ER 12.

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Storage Batteries. Be a battery man. We have all material and can give instructions for making them. Sample Plate 40c. Foreign countries 50c. Windsor Specialty Co., 5419 Windsor Ave., Chicago, Ill.

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Bargains. Big sale on guaranteed Radio Apparatus. C-300 Detector Tube, $4.67. Copper Aerial Wire, 49c. 100 feet. Detector Panel, $5.65. Numerous other bargains. Send for free list. Maynard Ralston, Wireless Electrical Dealer, North Baltimore, Ohio.

Regenerat.ve—constructed with Chicago Radio variometers ($27) photo details on request. Instructions for making same with photo and list of parts, 25c. Directions for constructing selective short wave regenerative using only one variometer, 40c. Abco Radio, 350 Linden Ave., Brooklyn, New York.

Audion Detector and Amplifier, V.T., 50 cents. Honeycomb coil mountings, 25 cents. Back mounted rheostats, 40 cents. Composition for molding your own knobs, panels, etc. 35c pound. Send stamp for particulars. Palmers Electrical Equipment Co., Duluth, Minn.

Radio Circuits On Blueprints are Convenient. Our VT circuits, each on a separate blue print, enable you to try out a large range of proven hook-ups. Set of twelve, receiving or phone and combination transmitting, 50c. Complete set of 24 for $1. The Plan Bureau, 1929 McCausland Avenue, St. Louis, Mo.

"A" Batteries. The N. Y. Times uses Wright Radio Batteries. Why not you? See ad on page 744.

Stop! Look! and Act! V.T.'s and Accessories. With each of the listed tubes—Radiotron U.V. 200 $5.00, and A.P. Moorhead Detector, $5.00; Radiotron U.V. 201, $6.50, and A.P. Moorhead Amplifiers $6.50. We will supply free of charge your choice of either of these four premiums—Latest FADA Rheostat $1.00, No. 810 Remler Bakelite smooth running rheostat $1.00, R. C. of Am. Porcelain V.T. Socket $1.00, or Murdock V.T. Socket, improved contact type. Either of the Federal single, closed or double circuit jacks, listed respectively at 70c, 85c and $1, will be given as premiums with each R.C. of Am. Amplifying transformer U.V. 712, $7.00; or Federal Amplifying Transformer $7.00. Fada 5 ampere Nichrome Power Rheostats $1.35, or R.C. of Am. Porcelain V.T. Socket, supplied free of charge with each $8.00 U.V. 202-5-watt Radiotron power tube for C.W. or Radiophone Transmission. We absolutely guarantee the foregoing apparatus. Only new and high grade equipment carried in stock. Unsatisfactory goods returns within five days replaced at once. All orders are filled within twelve hours and shipped postpaid and insured, thereby saving time and money. Remember us. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Turney Duplex Regenerative Receiver with instructions for hooking up. New—never used. Cost $15. Sacrifice $12. Rudolph Hartman, 148 So. Tyler St., Lancaster, Wis.

Short Wave Regenerator in mahogany cabinet $22.00. Variometers $3.85. Radisco L 750's at cost. Knocked down sets at low prices. Haas, 2011 Atlantic Ave., Atlantic City, N. J.

Twelve Hour Service. The Kehler Radio Laboratories.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 770, this issue. C. K. Dodge.

Amateur Constructors.—Stop paying high prices—build your own. Complete assembled and detailed blue prints for long and short wave tuner with photo of finished set, 50c coin. E. H. Cummings, 18 Richard St., Auburn, R. I.

Twelve Hour Service. The Kehler Radio Laboratories.

How Many Amperes will a certain sized wire carry safely? Table showing this, also giving 26 "Q" signals, formulae for calculating inductance, capacity, etc. Sent for 40c. Money order preferred. A. Beckwith, 614 North 32nd St., East St. Louis, Ill.

Lot of International Radio Co. variable condensers, very best construction, at prices way below wholesale. .0005 mfd $3.25; .001 mfd $3.50; .002 mfd $4.25. C. W. variable condensers .001 mfd, heavy plates, wide spacing $4.00. All condensers complete with dial and knob for panel mounting. Condensers in oak cabinets with ¼" bakelite panels $1.00 extra. Add postage. Bulletin for stamp. H. Butterworth, 331 Quincy St., Brooklyn, N. Y.

(Wireless continued)

Loop Aerials, 3½ feet high, shipped knocked down postpaid on receipt of money order for $2.50. P. Panico, 421 West 26th St., New York.

Look! Look! Look! Light two-inch serial insulators, with 50,000 volt high frequency flashover an ultimate tensile strength of 350 pounds at only $0.25 each. Insulated top binding posts with nickle plated base complete with brass screw and washer at $0.10 each. Bi-sectral wound honeycomb coils with each wire in each succeeding layer centered over the space in the layer immediately under it. Twenty-five turn coil, unmounted at $0.50 each, continued up to 1500 turn coil, unmounted at $2.50. The Radio Distributing Co., Abilene, Kansas.

Attendez Vous!—A standing offer till further notice. $1.00 worth of apparatus free with every $10.00 purchased, $2.00 with $20.00, and so on—an offer of unusual merit. Write for list and get in on this money saving plan. Port Arthur Radio Laboratory, Port Arthur, Tex.

Baldwin Phones. Further Reduction!! Why are Baldwin Phones so sensitive? Briefly because, (1) the small armature is pivoted and designed to act as a fulcrum when connected to the diaphragm by a small link. There is no tension or springing of metal as in ordinary receivers. (2) Four pole pieces of a single solenoid act upon both sides of a lightly balanced armature. (3) The force is concentrated at the exact center of a mica diaphragm (identically the same as used in all high grade phonograph reproducers). Original type "C" $,2.00; improved type "E" $13.00; lighter type "F" $14.00; anti-static type "G" $15.00. Single loud speaker unit type "C" without cord, $6.00. Type "E" single unit without cord, $6.50. These are the same units as are used in the vocaloud. With each pair of phones purchased we will extend or give as premiums, a one year's subscription to the Radio News, or the latest Federal Universal Plug, $1.75. These well known headsets are absolutely guaranteed and subject to return within five days if not satisfactory. Postpaid, insured, and twelve-hour service. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

GREBE! GREBE!! GREBE!!!? Notice the attractive premiums we offer for a limited time on the latest Grebe regenerative sets and vacuum tube control units with Bakelite Variometers, Shielded units and Vernier controls. Type CR-3 price $65.00; premium one pair type "C" Baldwin Phones $12.00. Type CR-8 price $80.00 or type CR-5 price $80.00; premiums 1 pair type "C" Baldwin Phones and 1 Federal Universal Plug. Type CR-9 Price $130.00 or type RORD Detector and two stage amplifier, price $75.00; Premiums, choice of Radiotron detector and two Radiotron V.T. Amplifiers or A.P. V.T. Detector and two A.P. V.T. Amplifiers Type ROK two-stage amplifier, price $55.00; premium your choice between two Radiotron V.T. Amplifiers or two A.P. V.T. Amplifiers. Absolutely new stock and guaranteed to be up to the usual well known Grebe standard; without question the finest constructed regenerative sets on the market representing the last word in Radio Construction. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Vocaloud Loudspeakers. With each Station Type Vocaloud, price $50.00, we will supply free of charge your choice of either A.P. V.T. Amplifier $6.50, or Sacoclad, Acme or Clapp-Eastman Amplifying transformers. Guaranteed. Postpaid. Insured. Twelve hour service. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Paragon V.T. Control. For a limited time we are offering the unexcelled and well known Paragon V.T. Control, regular price $6.00, at $5.20. Postpaid, insured, and twelve hour service. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Magnavox Loud Speakers. If you are interested in broadcasting your Radio Music all over your house or large halls with the Type R-2 Radio Telemegaphone in connection with the Magnavox power amplifier or type R-3 Radio Magnavox as well as the other Magnavox products, it will pay for you to send for bulletin and attractive bargains. Shipments direct from factory if desired. The Kehler Radio Laboratories, Dept. R, Abilene, Kansas.

Telephone and Musical Concerts; also Hawaiian and German Stations read with a single bulb. Are you satisfied with your receiving set? Would you like to build one that will receive over 6,000 miles on a single bulb and quit experimenting? One that will be the equal of any regardless of claims or price? Using the instruments you now have, you will be able to duplicate the long distance records you read about every day. Get our simple diagram of a complete short and long wave receiver, 175 to 20,000 meters, with which we read Honolulu, California, German, South American, French and English stations, and practically all the high powered foreign and domestic stations, amateurs as far west as New Mexico and numerous telephone and musical concerts come in good. Diagram and complete instructions, leaving nothing to guess about, will be promptly mailed for 50 cents in coin or stamps. Wire a set up and quit wasting good money. Virginia Novelty Co., Martinsburg, West Va.

Our Special Free Offer Advertised during December on page 548 of December Radio News repeated during February and March, as requested. We thank you. Port Arthur Radio Laboratory. Port Arthur, Tex.

Your Station Call in Color on 100 printed Government post cards for writing that station you have copied, $2.00 postpaid. Radio Press, Ottumwa, Iowa.

New Type Radio Magnavoxes with fourteen-inch horn, thirty-nine dollars. Ten per cent off on Burgess B batteries and Cunningham tubes. Write for bargain list. Radio supply Co., Weedman, Ill.

Bargain—Audiotrons—new $5, others. S. Strobel, 3923 N. 6th St., Philadelphia, Pa.

Sorsino Tunit—013.50 each, postpaid. Immediate deliveries. List for stamp. Jennison, 83 Russell Street, Waltham, Mass.

5-Watt CW Sets—$30! Worked over 500 miles. Most efficient and handsomest set on the mrket. 45-400 volts Plate Phone and buzzer modulator attachment $8.50 extra. Our 10-watt fone $60 with tubes! Investigate immediately! William Halstead, Greenridge Ave., White Plains, N. Y.

Variable Grid Leaks, 50c. Grid Condensers, 30c. Audion Panels $7.00. Hudson Radio Supply ,262 Palisade Ave., Jersey City.

(Wireless continued)

Honeycomb Coils. 25, 50 or 100 turns, 40c; 250 turns, 70c; 500 turns, 95c; 1,000 turns, $1.50; 1,200 turns, $1.85. All sizes carried, mounted $1.00 extra. Radiomart Company, Long Beach, Calif.

Variable Condensers, Unassembled, consisting of Plates, Washers, Shafts, Top, Bottom, Knob, Pointer and Scale. 23 Plate $1.85, 43, $2.85. Plate samples 10c. Gravenstede, 84 Hancock Ave., Jersey City, N. J.

Western Elec. Aeroplane Microphones $5.00. Carbon Cup Microphone 50c. Complete Filter System $9.00. Choke Coil for both legs of line $1.00. W. E. 21AA-1000 Volt 1 mfd. cap con. 1.50. Variometers 4.00. Variocouplers $3.50 Wound Variometer parts including brass fittings $3.50. Wound Variocoupler parts including brass fittings, $3.00. Cabinets 17 x 6 x 6½ in. deep Gum, $3.00. 2 Circuit Jack & Plug with cord $1.10. Bakelite Tubing 3" diam. $1.00 for 3 ft. length. Litz Wire 25-32 1c ft. 36-30 2c ft. Larvite Resistance Unit 48000 ohm, 50c. Other Bargains. Send for Bulletin. Haupt Radio Supply Co., 2442 Ogden Ave., Chicago, Ill.

Radio Storage Batteries. 6 volt 40-60 amp., $10 6 volt 60-80 amp., $12. All brand new and guaranteed W. & G. Tufts, 336 Newbury St., Boston, Mass.

The Wright Radio "A" Battery in Pairs (capacity to 120 Amp-Hours) is the last word in convenience, portability, super-quality. See ad on page 744.

How to Make Wireless Sending Apparatus.—100 pages—88 illustrations. Written and published entirely for the wireless enthusiast who wants to make his own radio apparatus. Contains more information on "how to make it" than any other book we know of. Paper bound, 35c. postpaid. Experimenter Publishing Co., Book Dept., 236-A Fulton St., New York City.

Telegraphy.

Telegraphy—(Morse and Wireless) and Railway Accounting taught thoroughly. Big salaries. Great opportunities. Oldest, largest school. All expenses low—can earn large part. Catalog free. Dodge's Institute, M St., Valparaiso, Indiana.

Wanted to Buy

Mail Old Gold, unusued postage, war and thrift stamps, Liberty Bonds, silver, platinum, diamonds, jewelry, watches, false teeth, magneto points, etc., new or broken. Cash immediately. Held ten days, returned if unsatisfactory. Ohio Smelting Co., 207 Lennox Bldg., Cleveland, Ohio.

Exchange.

Selling Entire Set. Write for list. Very reasonable. Leonard Tate, 807 Sixth St., Anacortes, Wash.

Sell—Several Wireless receiving sets, practically new. Write H. Wandru, 2211 Fifth Ave., McKeesport, Pa.

For Sale. Slightly used: Bell gap $20.00, Thordarson Oscillation Transformer $5.00, One Kilowatt Packard $20.00. All for $40.00. Oil immersed glass plate condenser for one kilowatt $15.00; 100 Watt, 500 volt, externally excited generator $17.00. Russell Widenor, 721 Wheeler Ave., Scranton, Pa. Radio 8AR1.

Bargains in radio apparatus and parts. Sending and receiving; also spools of wire. W. S. Willis, 347 West 14th St., New York City.

Sell—Marlin 25-20 pump—303 & 22 Savages— $18 Murdock Loose Coupler, $10—V.T.2, $4 Sherzer, 100 Hamilton Place, New York.

Sale—New Ammeters. R. L. Sharp, South San Antonio, Texas.

For Sale. 1 K.W. spark set complete DeForest panel type (ven) Vernier condenser. Never been used. Large spark coil with electrolytic interrupter, small magnet wire, chemicals and glassware, books, Formica panel 18 x 12 x ¼. Make inquiries. All answered. Owner died. Joseph Ricca, Box 126, Clairton, Pa.

DeForest .0005 90 deg. variable condenser $5. Harold Lathrop, Oneco St., Norwich, Conn.

Don't Buy a bicycle motor attachment until you get our catalog and prices. Shaw Mfg. Co., Dept. 1612, Galesburg, Kans.

Special!!! Detector panels $6; one step $10. Detector & 1 step, $15; two step $20. Act Quick. All apparatus new. Wallace W. Sofleiss, 9439 120th St., Richmond Hill, N. Y.

Trade—30-30 Winchester carbine, new condition $27.00—set $8.00 Reach boxing gloves $5.00—Duplex Keuffel Slide rule, new $5.00. Want Baldwin fones—receiving set, or cash. Harry Taylor, Winsper, Idaho.

Sell Clapp-Easthem 1 KW Coffin Transformer, $25. Rotary gap, $15. Radiation Ammeter, $5. Harry Schoenfelder, Boone St., Pottsville, Pa.

For Sale—Thordarson half kilowatt transformer, Dubilier condenser, heavy OT Racine rotary ammeter, kickback preventer, wavemeter $75. C. Porter, 17 Warrington Pl., East Orange, N. J.

For Sale: Condensers, key, H-C mounting, detector, etc. A-1 condition. Send stamp for list. Radio, steamer "Agwisun," Pierce Navigation Co,, Texas City, Texas.

Motorcycle and Sidecar—Want Magnavox. Palmer, Box 347, East McKeesport, Pa.

Sacrifice. 2 K.W. 120-cycle quenched spark panel type transmitter, Kilbourne & Clark gap. Complete with motor generator. Work from Farm Lighting Plant or City mains. $250. H. P. Sheard, Elk, Wyoming.

For Sale.—One new Electro Importing Co. Nauen (POZ) receiver. Good condition. Cost $45. Sell for $25. William E. Shipley, Quaker City Ohio.

Grebe Receiver CR3, $40. New $65. Raymond Schlegel, 1118 N. Negley Ave., Pittsburgh, Pa.

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P. O. Box 523, Far Rockaway, N. Y.

CANADIAN WIRELESS AMATEURS

Why pay high prices for regenerative sets, when you can get a high grade regenerative short wave receiving set, using plate and grid variometers, enclosed in a mahogany finished cabinet, panel engraved, all metal parts Nickel Plated, complete with AUDION. Price $35.00. For any further particulars, write to

A. E. HERRON, Terminal A, Box 62, Toronto, Can.

(Exchange continued)

For Sale.—CR1 type regenerative receiver custom made standard parts engraved $40. A. P. Southworth, 155 W. 84th St., New York City.

Sell Quick.—One receiving set consisting of one Wireless Equip. Co. receiver, two honeycombs, one audion detector and one pair "Brandes Superiors." First money order for $25 gets immediately shipment. This set will receive telephone as well as spark, and is almost new. W. C. Martin, Box 286, Blacksburg, Va.

Wanted, an omnigraph in good order. Paul McElroy, Hicks Wharf, Va.

For Sale, ¼ K.W. Blitzen transformer and condenser and O.T., $16. Guaranteed A-1 condition. Conrad Nelson, 864 York St., St. Paul, Minn.

Must Sell—Four new Cunningham C300 Detector Tubes; in original cartons, $4.60 prepaid. Karl Peterson, Lane, Illinois.

Trade: Cannon for Typewriter Chuck $3.50; Battery $4.50. Mele 59 Foxon, East Haven, Conn.

Sell.—20,000 meter cabinet receiving set $25. Smith motor wheel $25. George Metzger, Herkimer, N. Y.

Exchange, Kodak film tank for detector tube. Joseph Murphy, Ely Ave., Norwalk, Conn.

Sell—Honeycomb Set with Audion Control, $16. Leonard, Moore, Durham, N. H.

Sell—Professional loose coupler, $3.50. Murdock Variable Condenser .001 M.F., $3.75. Murdock phones No. 55, $3.50. 1½-inch Spark Coil, $5.50. Joseph E. Kral, Vail, Iowa.

For Sale.—National Radio Institute Natrometer $13.00. Receiving Set mounted in cabinet, $13. Willis Kulp, Rumilla, Pa.

Trade.—Printing outfit, value $25, for receiving set. Lamoreux, 905 West 34th St., Los Angeles, Calif.

For Sale—New Detector. Two Step amplifier with 3 new bulbs. Price $50. Quitting Radio. J. Hay, 1614 Pine St., New Orleans, La.

For Sale: Clapp Eastham regenerative receiver and V.T. control panel, $30; also crystal receiving set, $15; 1-inch spark sending set, $10. Money order for $50 takes everything, all new Xmas; get particulars, write. Edward Hogan, 22 Fenton St., Dorchester, Mass.

Navy Radio Material at lowest prices. Complete 500 cycle transmitters, meters, gaps, condensers, transformers, motor generators, etc. Henry Kienzle, 501 E. 84th St., New York.

For Sale.—Regenerative receiver, Grebe variometers. Particulars. Arthur Houlihan, Woodlawn Ave., Ansonia, Conn.

Exchange or Sell.—Regenerative Detector and two step amplifier enclosed in two beautiful mahogany cabinets, $45.00, or what have you got. Joseph Halperin, 1723 Melville St., Bronx, New York City.

For Sale.—One K.W. Thordarson Transformer $18. One Wilcox rotary gap, $8. One Murdock line protector $5.00. Chas. A. Gault, Ypsilanti, Mich.

Ten Dollars Takes: Long wave receiver grid leak and all. Geisbard, 113 Bay 13th St., Brooklyn, N. Y.

Sell.—Murdock Loose Coupler, 1500 meters, hardly used, $6.50. Joel Hayes, Port Washington, Long Island.

Trade or Sell, motor wheel and car. Write Walter Daniel, 1511 Fourth Ave., No. Great Falls, Mont.

Trade.—Carl Fisher 15 key Bb Clarinet, fine shape. Want radio apparatus. What have you? Gilbert A. Engen, Finley, No. Dak.

Storage Batteries for Wireless Telephone. Why take chances? Read on page 744 how the biggest stations finally got wise, and then get yours.

W. E. VT1 used one hour, $6; Cotoco variables .001 mf $4; .0005 mf $3; Brandes Superior headset, latest type, $5; Somerville dial indicators, $1; Van Der Bijl's "Thermionic Vacuum Tube," $2.50; "Radio Engineering Principles," $1.50. Everything perfect, sent C.O.D. J. K. Brennan Jr., Eolia, Missouri.

Bargains: Complete Radiophone transmitter, $35. De Luxe short wave Regenerator, $30. University regenerative receiver (range 180 to 24,000 meters), $50. Quantity of Bakelite tube sockets, each 50c. Crystal Receiver, complete, $10. P. H. Craig, 3397 Glenmore Ave, Cincinnati, Ohio.

Sacrifice. DeForest's OT5 Buzzer Radiophone, practically new, without tubes, $35. Cost $135. Order from this ad. L. F. Delbridge, 1314 Douglas St., Sioux City, Iowa.

Trade or Sell Cheap—Remington typewriter, Vest Pocket Kodak and case, Powerful Paris Army and Navy field glasses; Snow Shoes, Indian made; Hunting Ax with belt and Sheath. Have many other things. Want Regenerative, phones, audion, etc. Earle Burns, Athol, Mass.

Bargain—Thordarson ¼ K.W. Transformer, enclosed synchronous gap, O.T. Key, all in A-1 condition. 60 mile range. First $32.50 takes it. W. Brand, 733 Reeder St., Easton, Pa.

Sell—Navy 1 P-76 Wireless Specialty Apparatus Company receiver. Bargain, particulars. S. Anchilowitz, 633 Prospect Ave., New York City.

Call Changed, my call has been changed from 8 A.C. to 8 B.T.O. C.W. on 230 meters. A. L. Kent, 87 Chenango St., Binghamton, N. Y.

Sell, Grebe Supergenerative $40. Chicago Radio Regenerative, $35. Magnavox, new, $35. Detector, two-step, $30. Amrad Wavemeter, $4. DeForest Variable, sacrifice, $12. Western Electric Phones, $6. Brandes, $5. West Ammeter, $5. Milliammeter, $5. Eveready Storage, $10. Hoyt Ammeter, $3. Electrose Lead-in, $2. Burnt, German Amplifier Tube, $2. $30 Omnigraph, $15. Set drawing instruments, $4. Rex Visible Typewriter, $45. Charles MacCarron, 270 Jackson Ave., Long Island City, N. Y.

Bargain: Short wave regenerative, single coil ultra-audion long wave, switch change and detector on one panel. $65. Write description. Robert Onstott, Sharpsville, Pa.

(Exchange continued)

C. E. Regenerative, 19. Two step two bulbs, $24. Place, Sprague, Fall River, Mass.

Complete ¼ kilowatt transmitter. Ammeter. Write Radio 8 AMN, 837 High St., Williamsport, Pa.

Sell—Polar Cub universal 110 Volt motor, nearly new $5.00. 4 volt 35 amp. storage battery, new $12.50. Bargains! Dale Stoddard, 827 Kellogg, Ames, Iowa.

Marconi Type 106 Tuner, $45, with navy phones, $55. Also 3000 meter crystal set in cabinet with superior phones, $25.00. Stewart, 717 9th ave., New York City.

DeForest 20 Panel Set, complete with tubes and coils for only $145. Must sell at once for need the money to go through college. Includes 2 vernier condensers; detector and 2 step; "A" battery potentiometer, etc. Will sell only as a unit and shipped anywhere in U. S. completely mounted and wired, express prepaid. Good condition, only used 4 months. For further description write Stephen Tarnozzi, 102 Chittenden Ave., Columbus, Ohio.

Bargains! Universal Mignon 2,500 M. cabinet, cost $60.00 sell for $25.00. Sears Roebuck Regenerative Receiver, $25.00. Will trade. Want 500 v. generator, tubes, other radiophone apparatus. Whitney, 714 Vinton, Waterloo, Iowa.

Sell—Loose Coupler $4, Standard Dictionary of Facts, new (2 books), $10; Mandolin $3, Stamp Collection $30. Trade Stamp Collection for Honeycomb Receiver. C. Wood, 10 Harrison St., Oshkosh, Wis.

Two kilowatt open core Transformer Rumkorff Style, 110 V. removable core and primary, rubber covered; will give 12-inch spark with electrolytic interrupter, $75. Will trade for good typewriter. C. A. Herrick, 211 Lake Ave., Saratoga Springs, N. Y.

600-20,000 Meter Receiver, including Radiotron, $35. Box 205, Williamsport, Pa.

First Class Aerial, 3 wire 7 strand phosforos bronze, 45-50 ft. long, 2 poles about 18 ft. long, one loose coupler, 2,000 meters. Wm. J. Callahan, 607 Eagle Ave., Bronx, N. Y. City.

Marvel Receiver, used 1 month. Complete as advertised. Heard radiophone 35 miles, telegraph 300, $12. Replacing with audion. Arthur Damon, Brunswick, Ohio.

Bargains. Arnold Loose Coupler $10; P 500 Audion Control, without batteries, $11. De Forest 2 coil mounting $3 5000 ohm Potentiometer $1.75. Turney Spider Web Unit $3.50. Science & Invention June, 1919, to October, 1921, except November, 1919, 15c each. Write J. Eddy, 765 W. 8th St., Plainfield, N. J.

Bargain—Auto knitter with complete equipment. Knit and make money. Cash with order $20. Earle Burns, Athol, Mass.

Here You Are: Grebe CR-5, $60. Perfect conditions. R. Baumgartel, Grand Rapids, Mich.

Money Order for $20 will bring your Marvel Receiving Outfit. Gilbert Receiving set, Murdock Telephone, Switch, Galena. L. Jiminenez, Paragould, Ark.

Grebe Special CR3 For Sale, $50. First class condition. Telephone Elizabeth 699-J or write. Frank Brewer, 1185 Mary St., Elizabeth, N. J.

Memorize Continental Code in one hour. Qualify quickly for amateur license. See our ad on page 770, this issue. C. K. Dodge.

Short Wave Regenerative Receiver, $22. Ralph Haynes, 1236 American Ave., Long Beach, Calif.

Selling Out.—Compact tube control panel, $5; 17 plate V.C., $1.75; 43 plate V.C., with dial, $4; signal-type rec. set, $10; variometer, $3; D-L 400 Duo-Lateral coil, $1.75; 200 meter loose coupler, $2; 1 K.W. trans. set, $28. Postage extra. Write, James Kucera, 3459 East Blvd., Cleveland, Ohio.

Sell.—2" coil, $7; gap, $1; 2 variometers with Corwin dials, $2 each. Arthur Post, Harrison St., Passaic, N. J.

For Sale.—Complete radio set type R Thor. trans. oil condenser, O. T. Rotary Gap, and Wilcox Reg. Rec. with Batt. complete, $85 or will sell separately. J. Hune, 100 W. 10th St., Holland, Mich.

First Draft for $10 takes Audion control panel with tube. Brandes Superior phones, $5. Brewster Woodburn, Hampton, Iowa.

For Sale.—DeForest unit set special 15 panels including detector and 2 step Vernier type condensers, Tuska plate variometer, variable grid and plate condensers, complete with radiotrons, phones, B batteries, coils, etc. All in fine mahogany cabinet and practically new. Cost $200. First check for $135 takes it. Harry W. Thomson, Millbury, Mass.

For Sale or Exchange.—One new 5BB improved navy type receiving transformer, never been used. Cost $21.95, for $12 or what have you to exchange. Address L. A. Case, 6446 Ellis Ave., Chicago, Ill.

For Sale.—Triple coil mounting with gears and pinions $9. Brandes superiorphones $6. Interstate receiver with special receiver $6.50. Hobart Gates, Pierre, S. D.

Trade.—Old stamp collection for radio apparatus. M. Vickers, Jr., 1372 Hildreth Ave., Columbus, Ohio.

Exchange.—1" spark coil, large condenser, O. T. spark gap, anti-capacity switch for power transformer or cash. P. Hyman, 51 Sheldon St., Springfield, Mass.

Regenerative Receiver, detector, phones, complete $33. For particulars write Edward Hudowalski, Paterson, N. J.

For Sale.—Mignon RW4 undamped wave receptor $50. Duck's 28" loading coil, $5; Ravenswood O.T., $10. All A-1 condition. Write 9 AIY.

German Huth 3 step amplifier with tubes and phones, new $75; Det. and 2 step radiocraft, used, $30. Orth, 832 Clarence Ave., Bronx.

Wanted.—Grebe CR5, Paragon RA-Ten or equivalent. Must be in good condition and dirt cheap. State price, whether any parts needed for short wave reception, and particulars. John A. Rhea, 890 Broadway, New York.

Sell No. 6 Erector, $7. Microscope $3. Both good condition. J. Everett, Big Rapids, Mich.

Nobody Wants Your Junk Battery. Get a New Wright Radio Special and forget the old one. Better yet, get two of them and forget all your troubles. See ad on page 744.

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"Practical Chemical Experiments"—a department by Professor Floyd L. Darrow, in which he shows by plain wording and illustrations how to make simple food tests.

"The Constructor"—this section contains hintful and practical ideas by H. Johnstone on how the amateur may build or construct useful things in a quick, cheap manner.

"Popular Astronomy"—by Isabel M. Lewis, the well known author on astronomy.

"Fortunes From Little Things"—Charles Frederick Carter writes this department, in which he gives some startling information—how inventors have been made rich quick by inventing simple but useful articles.

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(*Continued from page 787*)

erates sustained oscillations in both circuits of a frequency dependent upon the electrical time period of the circuits, and may be used as a transmitter in continuous wave telegraphy and telephony or as the local source of oscillations in the Heterodyne or Beat method reception. Also known as Oscillion.

Valve Tuner—One used in conjunction with a valve detector. Has three adjustable circuits. Aerial Tuning Circuit, a variable condenser placed between a variable inductance in series with aerial and an inducing inductance connected to earth. Valve Circuit: Inductance, secondary of tuning jigger, in series with telephones potentiometer and vacuum in valve between filament and surrounding sheath; has a double billi condenser placed across valve and telephones. Intermediate Circuit: two fixed inductances placed across a variable condenser, the whole being between aerial and valve circuits.

Variable Condenser—One whose capacity is readily altered.

Valve, Vacuum—A form of detector for electric oscillations invented by the author It consists of an electric glowlamp, either metallic filament or carbon filament having a cylinder adjacent to or surrounding the filament but not touching it. This is carried on a wire sealed through the bulb and connected to a third terminal. When the filament is rendered incandescent by a continuous current the space between the filament and the metal plate possesses a unilateral conductivity, and negative electricity can pass from the filament to the plate and not in the opposite direction. It is used as a rectifier of electric oscillations to rectify trains of oscillations into gushes of electrcity in the same direction, and render them audible on a telephone.

Variations—Changes which occur from time to time in Dip and Inclination. A more or less regular variation takes place daily and is known as Daily Variation. Also an Eleven Year Period which has been noticed to coincide with maximum "Sunspots" A large irregular variation is called "Magnetic Storm," which is in no way connected with a thunder storm.

Variations of Compass—Variations.

High Voltage for the V-T.

(*Continued from page 711*)

The converter can be mounted on a suitable base, and is a good addition to any station, ready for use in case of emergency should the high voltage battery fail; a filter should be used with it.

A converter constructed in this manner will not cost more than $7 or $8, or the cost of the motor and a little work in adding the slip rings. The motor generator set can be made up for from $10 to $25, or the cost of the two motors or generators.

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FEBRUARY, 1922

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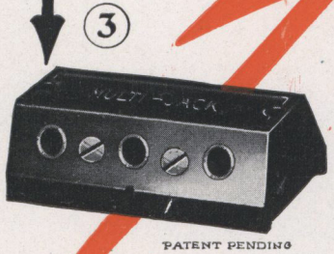

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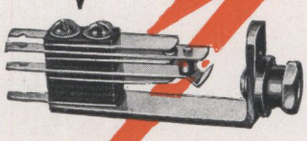
Here is another worthy member of the Pacent plug and jack combination. This is really three independent jacks built into a beautiful composition base. The Multijack can be used with Pacent Universal Plugs or Pacent Twin Adapters. The Multijack is more than a mere convenience; it is a necessity. Screwed to the side of a receiving outfit it will allow three sets of 'phones to be plugged in or two sets of 'phones and a loud speaker. It may also be screwed to the table or the testing board. All standard plugs will fit into it, but it was designed especially for use with the Pacent Universal Plug. THIS IS STILL ANOTHER PACENT RADIO ESSENTIAL. Catalog No. 52 Pacent Multijack, Price $1.50.



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While the Pacent Radio Jack of the standard type fulfills most radio requirements, there are certain advantages to be derived from the use of the automatic type, which permits the filaments in any part of the amplifier to be automatically cut off when not wanted, without necessitating an additional switch or touching the rheostat. Inserting the usual plug in the Pacent Automatic Radio Jack lights the filament of the vacuum tube in that particular circuit, while withdrawing the usual plug shuts off the current from the filament. Catalog No. 66 Pacent Automatic Jack, Price $1.50. Supplied in other styles.

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Twenty years ago, radio was a scientific plaything; today it is a world necessity; twenty years from now it will eclipse all other methods of communication. Train yourself now in a professional way and cash in on some of the opportunities that are presenting themselves in the radio field. Do not be a stay-behind. Do not let the other fellows beat you to the high-paying jobs when they are within your grasp at this very moment. Many thousand trained radio men will be needed this year. Prepare yourself now and step into a real radio job next spring. You can have your choice of operating either on land or sea.

Put the Final Polish to Your Training. Do Not Stop Half Way

Many wireless amateurs are so absorbed in the fascinating work of radio that they do not realize that big opportunities await them in the commercial field. They love the work and yet they do not seem to appreciate how urgently the field of radio communication needs trained men. Some of them do, however. We can name twenty-five big radio men, whom you know, who have climbed to their present position by putting the final polish on their radio education. You can do the same thing. America's largest and oldest radio school is holding out its hand to you. It will help you to the last step. It will broaden you out into a professional radio man, with a keen insight into the commercial side of radio communication. It will also complete your technical education and put you in a position of trained radio expert.

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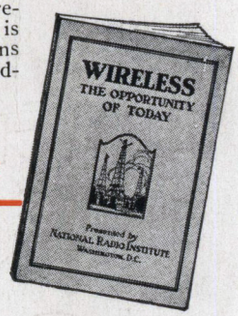
Many other amateurs have cashed in on the opportunities in radio. You should do the same. There is nothing to prevent you. A few hours each week and a few cents a day will complete your training within four months. Start now. Send for our interesting booklet, "Wireless, The Opportunity of Today." It is yours for the asking with no obligations attached. Your copy is waiting to be addressed.



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